CHAPTER 2

DESCRIPTION OF ALTERNATIVES

CHAPTER 2: DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This chapter summarizes the proposed action: a copper/silver mine, mill, tailings storage facility, and evaluation adit. Reasonable alternatives to the proposed action that were described and analyzed in the draft and supplemental EISs are also described. Part I of this chapter, Issues and Development of Alternatives Process, summarizes how the Kootenai National Forest (KNF) and Department of Environmental Quality (DEQ) (the Agencies) developed alternatives analyzed in this EIS. Part II, Description of Alternatives, describes the proposed action and four alternatives including the no-action or permit denial alternative. Part III, Alternatives Considered but Dismissed from Further Study, describes alternatives considered but dismissed from detailed analysis in this EIS as well as the rationale for their dismissal. Part IV, Description of Reasonably Foreseeable Activities, discusses and summarizes the reasonably foreseeable future activities included in the project area. These include the relicensing of the Washington Water Power dams and the implementation of the Tri-State Implementation Council's management goals for the lower Clark Fork River and Lake Pend Oreille as well as the Montanore Project, and other activities. Part V, Comparison of Alternatives, compares the features and impacts of each alternative described in this chapter and analyzed in Chapter 4 to the issues used for alternative development. Part VI identifies the Agencies' preferred alternative.

PART I: ISSUES AND DEVELOPMENT OF ALTERNATIVES PROCESS

Identification of Issues

The Agencies identified the significant issues that would be used as criteria in defining and evaluating the alternatives from written comments and a series of public and agency meetings. Eight issues, defined as indicators of potentially significant effects, emerged from the scoping process and Agencies' discussions. No new issues were identified from public comments on the draft and supplemental EISs. However, public comments focused on effects on quantity and quality of surface and ground water, tailings impoundment/paste facility stability, and visual impacts of the tailings storage facility. The effects have the potential to be adverse or beneficial, to be severe or long-lasting, to affect a large area, or to occur frequently when a resource's quantity, quality, fragility, or uniqueness are considered. The description of each issue and the means for predicting its associated impacts are provided below and do not represent a conclusion about the effects of the project.

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

Discharges and activities associated with the Rock Creek Project may change the ambient (existing) surface water quality of Rock Creek, the Clark Fork River, and Lake Pend Oreille, and ground water quality. *Effects are predicted by estimating changes in selected water quality parameters of surface and ground waters and changes in the composition and abundance of aquatic life.*

Seepage from the tailings impoundment/paste facility and underground mine water reservoir may alter ambient ground and surface water quality. *Effects will be predicted by estimating changes in selected ground water quality parameters of selected wells.*

The proposed water withdrawals and diversions may affect existing water users. *Effects will be predicted by estimating changes in concentrations of selected parameters and the quantity of water available for users.*

Seepage into underground mine workings may affect water balance in wilderness lakes, wetlands and flow rates of springs. *Effects will be predicted by estimating mine inflow and changes in lake levels, ground water exchange in lakes, and spring flows to the extent possible.*

Issue 2: Effects on fish and wildlife and their habitats and current and proposed threatened and endangered species.

The proposed mining activities and mining support activities may adversely affect grizzly bear (threatened species) because of direct habitat loss, displacement, disruption of travel routes, and increased mortality. *Effects will be predicted by estimating changes in open road density (miles of open road per square mile) and percent of each bear management unit that provides seclusion from humans.*

The proposed mining activity and mining support activities may adversely affect big game because of habitat loss or degradation, displacement, disruption of travel routes, and increased mortality risk. *Effects will be predicted by estimating changes in open road density, habitat quality, and mortality risk.*

The proposed mining activities and mining support activities may affect neotropical migrant birds from habitat change, loss, or degradation and displacement and/or replacement of species using the area. *Effects will be predicted by estimating acres of habitat altered.*

The proposed mining activities and mining support activities may adversely affect mountain goats because of habitat loss or degradation, displacement, disruption of travel routes, and increased mortality risk. *Effects will be predicted by estimating acres of habitat altered and changes in habitat quality and mortality risk.*

Disturbance from the proposed mining activities may affect other threatened and endangered or proposed species (bald eagle, lynx, and gray wolf) currently using the area. Threatened and endangered species may be subject to adverse habitat modification as well as to an increased mortality risk. *Effects will be predicted by estimating acres of habitat affected and changes in habitat quality, mortality risk, and open road density.*

The proposed mining and support activities may adversely affect sensitive animal species (harlequin duck, fisher, wolverine, Coeur d'Alene salamander, northern bog lemming, Townsend's big-eared bat, black-backed woodpecker, flammulated owl, northern goshawk, peregrine falcon, northern leopard frog, and boreal toad) and Forest Service management indicator species (mountain goat, elk, white-tailed deer, and pileated woodpeckers) due to habitat loss or degradation, displacement, disruption of travel routes, and increased mortality. *Effects will be predicted by estimating acres of altered habitat and changes in habitat quality and mortality risk.*

The proposed mining and support activities may affect threatened or sensitive fish species (bull trout and westslope cutthroat, respectively) and/or those proposed for listing as threatened. The effects on these species could include habitat loss or degradation, and increased mortality risk. *Effects will be predicted by estimating changes in surface and ground water parameters, changes in habitat quality, changes in abundance and composition of aquatic life, long term population trends, reproduction success, and growth rates of fish species.*

Water from the underground mine reservoir could potentially migrate from the reservoir through fractured faults and joints. *The ultimate destination of, and volume of stored water that could leave the reservoir is not possible to quantify.*

Issue 3: Stability of the tailings impoundment/paste facility.

Failure of the tailings impoundment/paste facility may have substantial adverse effects on water quality, public safety, aesthetic quality, downstream facilities, aquatic life, and long-term reclamation success among others. A comprehensive Quality Control/Quality Assurance program should be part of any proposed design. Probability of failures can be measured by documenting foundation strength parameters, tailings properties, and seismic response. Phreatic surface location and associated seepage analyses will also be used in the technical review of the impoundment design. *Effects of failure can be predicted by estimating impacts to surface waters and aquatics/fisheries as described above. The potential risk of failure will also be estimated.*

Issue 4: Impacts to socioeconomics of surrounding communities.

The proposed project may affect local employment, local income, the size and location of the area population, school, fire, public safety and other public services, local tax revenues, and public expenses. *Effects will be predicted by estimating changes in employment, population, demographics, government services, local economies, and fiscal condition in Sanders and Lincoln counties, Montana, and Bonner County, Idaho.*

Issue 5: Effects on old growth ecosystems.

The proposed project may impact old growth stands. *Effects will be predicted by estimating the acres of old growth directly lost, changes in old growth effectiveness, and changes in designated Forest Service old growth management areas.*

Issue 6: Effects on wetlands and non-wetland waters of the U.S.

The proposed project may destroy or affect wetlands and non-wetland waters of the U.S. *Effects will be predicted by estimating the number of acres destroyed, dewatered, or otherwise affected and by the loss/decrease/change in functions and values of the affected wetlands and non-wetland waters of the U.S.*

Issue 7: Effects on public access and traffic safety.

The proposed project could adversely impact public recreational access and use patterns such as hunting, berry picking, camping, sightseeing, and hiking. *Effects will be predicted by estimating the number/miles of roads closed/opened.*

Public safety is a primary concern on proposed service roads and Montana Highway 200. *Effects will be predicted by estimating changes in average daily traffic volumes.*

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

The proposed mining and support activities may create noise that exceeds ambient levels. *Effects will be predicted by estimating changes in dBAs (decibels in the A scale) and significance of areas exposed to elevated noise levels.*

The proposed project may change the existing scenic quality and visual character of the Clark Fork Valley and Rock Creek drainage. *Effects will be predicted by the degree of compliance with Visual Management Systems (VMS) visual quality objectives following life of the project, by analyzing visual contrast of proposed facilities with the existing landscape, and by estimating reclamation success.*

The portal of an air intake ventilation adit is proposed in the wilderness. Wilderness users might notice sights, sounds, and smells from the proposed project that could affect their wilderness experience. *Effects will be predicted by those items listed above for noise and scenic quality and by estimating changes in concentrations of air pollutants (particulates and trace metals).*

Development of Alternatives

In an EIS, the Agencies are required to evaluate the environmental effects of the proposed action and reasonable alternatives to it. The Agencies must also consider a no-action alternative.

Alternatives other than the proposed action and the no-action alternative were developed by the Agencies in response to identified environmental issues. The intent of these alternatives is to minimize potential negative environmental impacts by modification of planned operations, mitigation and monitoring plans, and/or relocation of any or all of the proposed project facilities. The development of material needed to prepare responses to public comments on the draft EIS led to the development of one new alternative that was described in the supplement to the draft EIS. All action alternatives include amending the Kootenai National Forest Plan to change Management Area allocations.

Alternatives to the proposed action consist of reasonable modifications to various elements of the proposal. These modifications fall into two main categories -- those that modify the location of facilities and those that modify or change the methods and procedures employed in the operation. One or more modifications to different elements were combined in the Agencies' alternatives in order to address the significant environmental issues identified earlier. Mitigations are also proposed in conjunction with these modifications. Table 2-1 identifies which issues are addressed by the modifications carried forward into one or more of the Agency alternatives described in this EIS.

TABLE 2-1
Modifications Versus Issues

Modifications Carried Forward to One or More Agency Alternatives	Issues Addressed by Modifications							
	1: Water	**2**: Fish & Wildlife	**3**: Tailings Stability	**4**: Socio-economics	**5**: Old Growth	**6**: Wetlands	**7**: Traffic Safety	**8**: Aesthetics
Facilities Locations:								
Mine Portal and Mill Site	X	X		X	X	X	X	X
Tailings Impoundment/ Paste Deposition Siting	X	X	X		X	X		X
Air Intake Ventilation Adit		X						X
Utility and Road Corridors	X	X			X	X	X	X
Rail Sidings				X		X	X	X
Water Treatment Plant Location		X				X		
Methods and Procedures:								
Water Treatment Systems	X	X						X
Tailings Surface Disposal Methods	X	X	X			X		X
Modifying the Rail Loadout Facility	X	X					X	

Location of Facilities

Alternate locations for each of the facilities were considered in response to issues and concerns associated with their respective location. Alternate locations for a mine portal and mill site, tailings impoundment/paste deposit, air intake ventilation adit, utility and road corridors, rail sidings, and a water treatment plant were considered.

Mine Portal and Mill Site. In 1986, the Forest Service published the Mineral Activity Coordination (MAC) Report detailing the findings of a tailings and mill facility siting study conducted for the Cabinet Mountains (U.S. Forest Service Kootenai National Forest 1986). This study included an evaluation of various potential tailings and mill facility locations for the proposed Rock Creek Project and the now-permitted Montanore Project, and other potential proposals in the south Cabinet Mountains area. The siting study identified seven potential mill sites for the Rock Creek Project: one site on the East Fork Bull River, one site on Copper Creek, and five sites in the Rock Creek drainage. Ultimately, three mill sites in the Rock Creek drainage were further evaluated (see Figure 2-1). Only two sites were carried forward as alternative mill sites (see Figure 2-2). The reasons for dismissing the other sites are summarized in this chapter under Part III: Alternatives Considered but Dismissed From Further Study.

Tailings Impoundment/Paste Facility. The MAC Report identified potential sites for tailings impoundments based on mill site locations. These same sites were determined to be potential sites for paste deposition of tailings.

The following criteria were applied to screen potential tailings impoundment locations.

(1) Tailings location should be less than 10 miles from the mill site.

(2) Tailings location should be at a lower elevation than the mill site to provide gravity-assisted flow of a tailings slurry.

(3) Tailings location should have relatively gentle terrain (less than 10 percent slopes).

(4) Tailings locations should have foundation conditions that could be reasonably expected to support an impoundment facility.

(5) Use of the tailings location would not require diversion of a major stream.

Potential siting options were also reviewed in detail by the applicant. These initial reviews considered potential tailings disposal sites in conjunction with several potential locations for the mill facility. Aside from the criteria listed above, the applicant proposed an additional criterion: that there should be a relatively unobstructed transportation corridor between the tailings disposal and mill sites.

As project definition proceeded, the possible locations for the mill were reduced to sites in the Rock Creek drainage, thereby eliminating the three tailings alternatives that were associated with the East Fork Bull River and Copper Creek mill locations. The MAC Report identified four alternative tailings sites for the proposed project with its mill located in the Rock Creek drainage (see Figure 2-1).

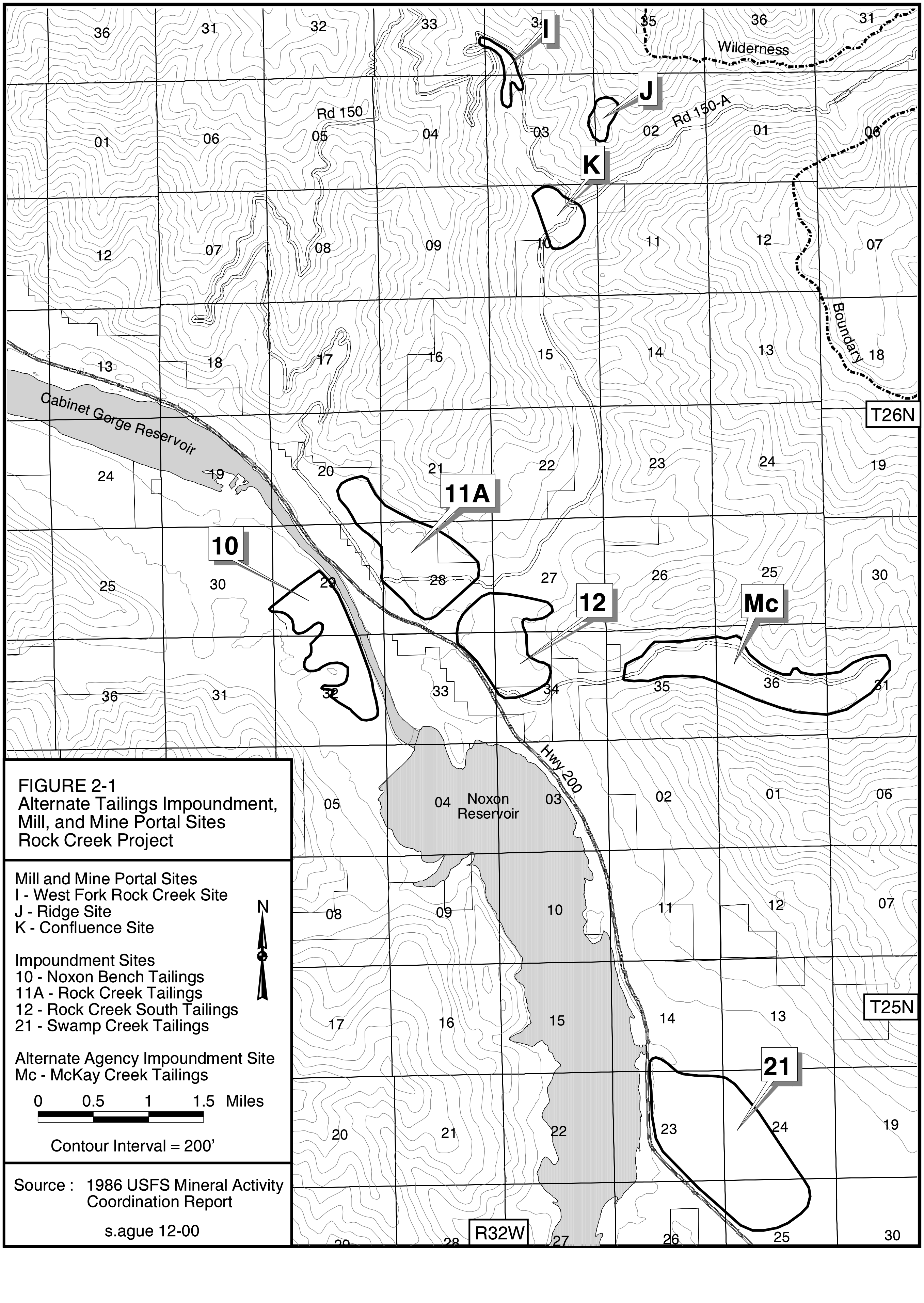


FIGURE 2-1
Alternate Tailings Impoundment, Mill, and Mine Portal Sites
Rock Creek Project

Mill and Mine Portal Sites
I - West Fork Rock Creek Site
J - Ridge Site
K - Confluence Site

Impoundment Sites
10 - Noxon Bench Tailings
11A - Rock Creek Tailings
12 - Rock Creek South Tailings
21 - Swamp Creek Tailings

Alternate Agency Impoundment Site
Mc - McKay Creek Tailings

Source : 1986 USFS Mineral Activity Coordination Report

s.ague 12-00

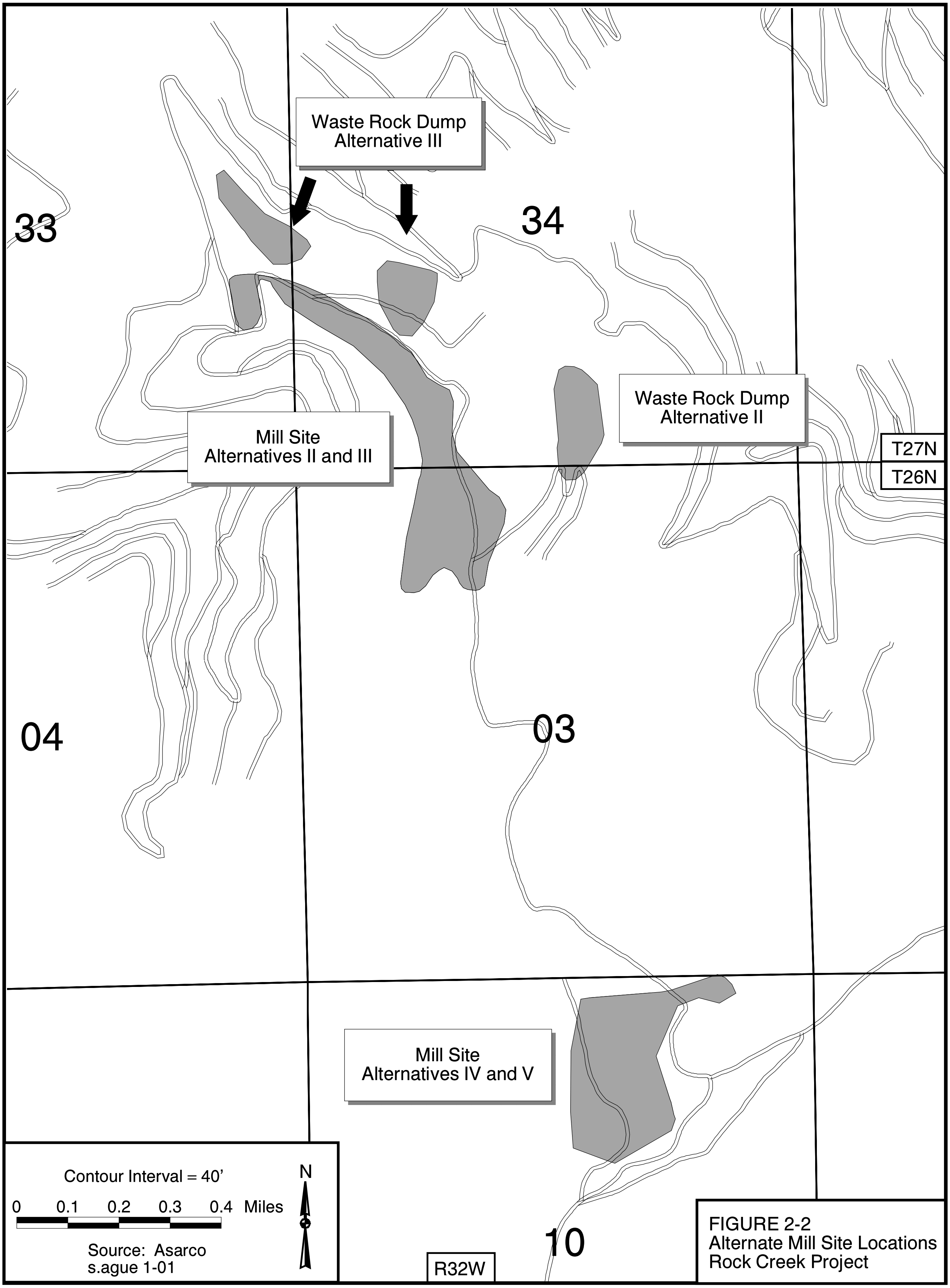


FIGURE 2-2
Alternate Mill Site Locations
Rock Creek Project

The Agencies determined that only the proposed impoundment site met the MAC Report and the applicant's criteria, and was large enough to contain all the tailings to be generated by the proposed project and deposited in a tailings impoundment.

Subsequent to the MAC Report, the Agencies undertook another review of tailings impoundment siting options. This review combined construction method with location options to evaluate the potential for constructing specific types of tailings impoundments at several sites and the potential for using two sites simultaneously for tailings disposal. The McKay Creek site (see Figure 2-1) was included in this re-evaluation. These reviews are summarized in Alternatives Considered but Dismissed From Further Study in Chapter 2 of this EIS.

The discussion of surface disposal of tailings as a paste was developed as an alternative during the investigation of paste backfilling of tailings into underground mine workings. The volume of paste tailings remained basically the same as for traditional slurried tailings. The Agencies reviewed the tailings impoundment sites at Rock Creek, McKay Creek, Swamp Creek and Noxon Bench for paste deposition. Criteria for determining suitability of a site for paste deposition include the following:

(1) Maximum efficient pumping distance of paste was 2,500 feet before additional pumps would be required. The paste plant would need to be relatively close to the tailings deposition location(s).

(2) The greater number of pumps could result in a greater amount of downtime for maintenance and repair. Costs would be greater if many backup pumps had to be available.

(3) Pumping paste from a paste production plant would be done under higher pressures than piping tailings slurry from the mill to the impoundment site (500 pounds per square inch [psi]). Stream crossings and long distances of pipeline could increase the potential for pipeline ruptures and greater potential for impacts than from a ruptured tailings slurry line.

(4) Tailings would need to be slurried from the mill to the paste production plant before being dewatered. This would require a down-gradient paste plant location from the mill.

(5) Deposition locations should have foundation conditions that could be reasonably expected to support the necessary weight of the tailings paste.

(6) The tailings deposition location would not require diversion of a major stream.

Based on these criteria the Agencies determined that only the proposed impoundment site on the west side of Rock Creek and a smaller site on the east side of Rock Creek were suitable for tailings paste deposition. The east side site is only suitable for partial retention of tailings and would require that the majority of the tailings be stored on the west side. The dismissal of alternate sites for paste deposition are described in Part III: Alternatives Considered but Dismissed From Further Study in this chapter of the EIS.

Air Intake Ventilation Adit. The Agencies identified an alternative that would reduce impacts on the Cabinet Mountains Wilderness (CMW) by relocating the air intake ventilation adit to a cliff area to minimize disturbed acreage.

Utility and Road Corridors. The applicant's proposed mine road and highway intersection do not meet current Montana Department of Transportation (MDT) standards, so an alternative was developed. The Agencies combined road and utility corridors and relocated other mine-related roads, where possible, to minimize other resource impacts.

Rail Sidings. The Agencies analyzed alternatives that met Montana Rail Link criteria. Alternative rail sidings are summarized in Part III: Alternatives Considered but Dismissed From Further Study. Ultimately, only one, a site near Miller Gulch was chosen.

Water Treatment Plant Location. The applicant's proposed water treatment facility would be located between the northeast corner of the impoundment and Rock Creek just upslope from the proposed wetland mitigation site at borrow site #3. The Agencies determined that there was a potential for impacts to effective development and function of the wetland mitigation site with the proximity of the water treatment facility. Alternative sites along FDR No. 150 and the pipeline corridor were investigated. Criteria for selection of an alternate site included (1) keeping the site at least 300 feet from the creek, (2) keeping the site as close to the highway and the impoundment as possible to help minimize noise and disturbance impacts to wildlife and fisheries, and (3) avoiding additional disturbance to wetlands and non-wetland waters of the U.S. as well as old growth timber. The Agencies also wanted to keep the plant either on Sterling or NFS lands.

Evaluation Adit Support Facilities Site. The applicant's proposed evaluation adit support facilities site is located close to FDR No. 150 and a stretch of Rock Creek that is considered important harlequin duck habitat. Reclamation of the site could lead to increased public use of the site for camping and access to Rock Creek increasing disturbance of the ducks. The applicant was asked to provide an alternate site in the vicinity of the tailings paste facility or waste water treatment plant and at least 300 feet from Rock Creek to minimize potential disturbance of harlequin duck habitat.

Methods and Procedures

Alternate methods and procedures for certain operations were also considered in response to issues and concerns. Three operations were identified where different methods or procedures were available for consideration. They were the water treatment system, tailings surface storage methods, and design and operation of the rail loadout facility.

Water Treatment Systems. Water treatment systems proposed in the draft EIS consisted of a semi-passive biotreatment system with an ion exchange backup system. Alternative water treatment methods have been considered by the Agencies in response to the issues and concerns associated with the proposed operating plan. These include other conventional water treatment facilities such as reverse osmosis, semi-passive biotreatment systems, Land Application Disposal (LAD), constructed wetlands, and segregation of water. The applicant suggested the changes described in Alternative V of this EIS in response to public comments on the draft EIS. The revised method of mine discharge water treatment includes pressure filtration, settling sumps, and a semi-passive biotreatment system and a reverse osmosis system. Changes to the proposed water monitoring plan have also been developed. The applicant has proposed collection of seepage from the tailings facility with a perimeter recovery system consisting of drains and if required by DEQ, pump-back wells. Collected tailings seepage would be pumped back to the reclaim pond on the impoundment. Seepage recovery for the tailings paste facility would consist of an underdrain system. Seepage collected from the paste facility would be routed to the mill through the paste plant for reuse as process water during operations. At mine closure, collected seepage would be routed through the waste water treatment facility and discharged to the Clark Fork River. Seepage would continue to be treated until it met ambient ground water quality without a mixing zone. If seepage continued to contain pollutants, then a discharge permit and mixing zone would continue to be required.

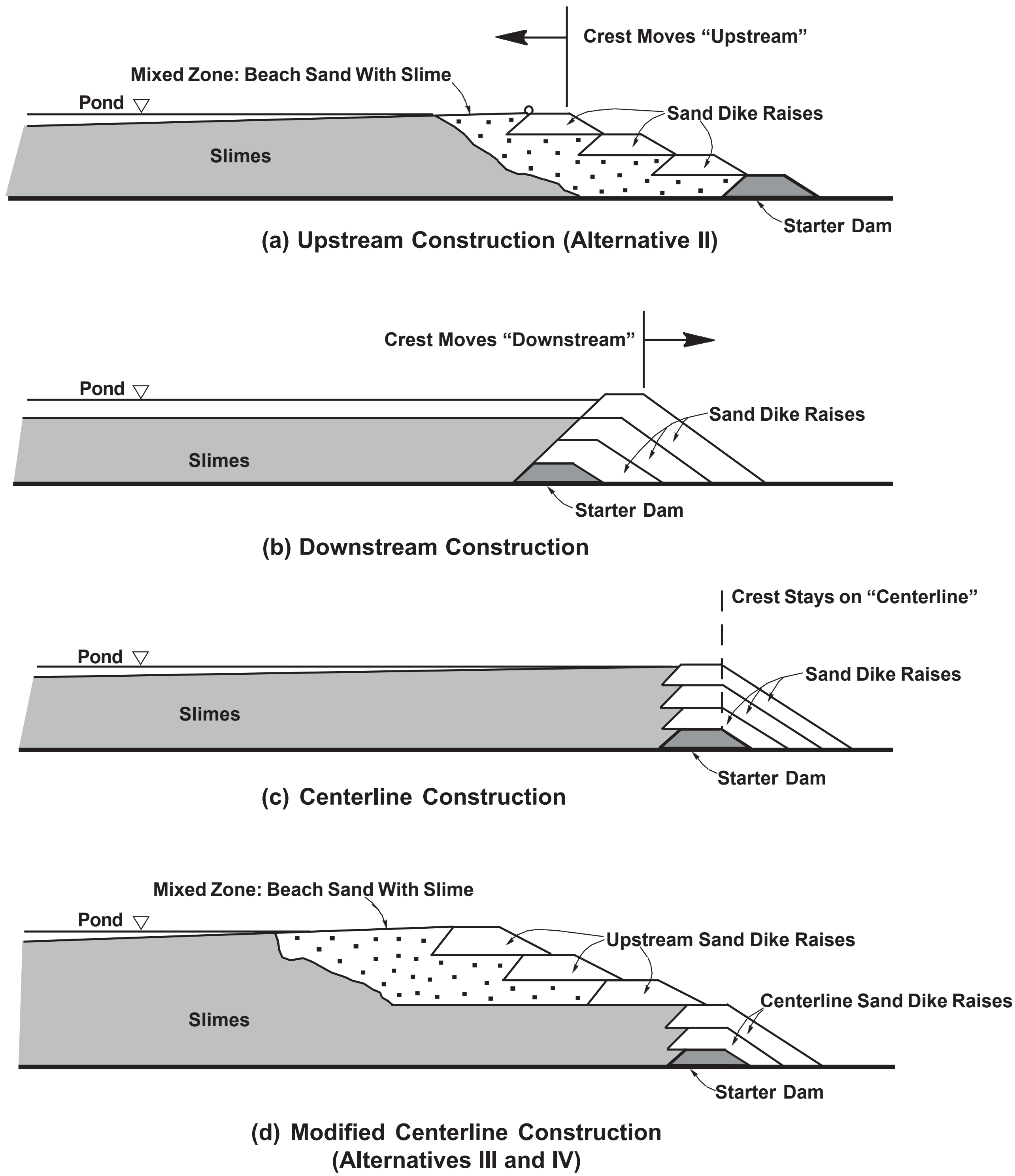
Tailings Surface Storage Methods. Two basic methods of storing tailings on the ground surface are being considered. The first is the more conventional method of storing slurried tailings in an impoundment behind a retaining embankment. The second method involves depositing the tailings on the ground as a paste, much like building a free-form concrete structure.

Various methods of tailings impoundment construction are reviewed in detail in Appendix G of this EIS. For the amount of tailings associated with the proposed action (100 million tons), only staged embankment construction was considered a viable impoundment construction method. This type of tailings retention structure uses the sand portion of the tailings as its primary construction material. This tailings sand is sequentially added to the embankment in stages to build the dam that retains the tailings. There are three general categories of staged embankments. They are named according to the horizontal direction the crest of the dam moves during its construction lifetime; 1) upstream, 2) downstream, and 3) centerline. In addition, there are hybrid styles of construction, such as the modified centerline, that combine construction methods to adapt them to specific sites (see Figure 2-3).

The applicant proposes to deposit tailings on the ground surface as a paste for Agency review and consideration as an alternate method of disposing tailings (Golder Associates 1996, Knight-Piesold 1997). This proposal was an outgrowth of investigating the use of paste technology for both backfilling the mine and depositing the tailings on the surface in response to public comments on the draft EIS. Paste deposition consists of dewatering the tailings to create a paste with a known consistency (20 percent water and 7-inch slump) along with a binder, if necessary, and placing the paste on the surface. More information about paste deposition can be found in the Alternative V description in this chapter.

The Agencies reviewed the various construction methods to address concerns about stability and amount of disturbed area. Each construction method has corresponding seepage and drainage collection systems.

Rail Loadout Facility Operation. Recent investigations into potential lead contamination at the Troy Mine loadout facility in Troy, Montana, have led to concerns that a similar situation could develop at the Rock Creek rail loadout facility. To prevent possible lead contamination of the ground and surface waters, the Agencies and the applicant determined that the rail loadout facility needed to completely contain the concentrate. All components of the concentrate storage and railcar loading process would be contained within an enclosed facility. The railcars would also be covered to minimize the risk of spills



SOURCE: Dames and Moore, Alternate Tailings Impoundment Design, 1992

FIGURE 2-3
Impoundment Construction Methods
Rock Creek Project

enroute to the smelter. Additionally, instead of trucking concentrate to the loadout facility, under Alternative V the concentrates would be slurried to the loadout facility in a buried pipeline and dewatered at the facility. Reclaimed water would be pumped to the mill for reuse.

Alternatives Considered in the EIS

Five alternatives were carried forward for consideration in this EIS. Implementation of any of the action alternatives would result in a requirement to modify the Forest Plan for Management Area changes. Brief descriptions of the alternatives follows:

Under Alternative I, the no-action alternative, the project would be denied or bought out by public agencies. The no-action alternative provides a baseline for estimating the effects of other alternatives.

Alternative II is Sterling's proposed plan. Sterling would construct, operate, monitor, and reclaim the Rock Creek Project as proposed in the plan of operation and application as well as in its air quality permit application and MPDES permit application. The Agencies would issue the necessary permits and approvals.

The remaining three alternatives are the Agencies' action alternatives. They include various combinations of modifications to Alternative II and mitigations. Several of these modifications and/or mitigations include or refer to the development of plans. Since a permit, if approved, must also contain all approved mitigations or stipulations, the applicant would need to prepare replacement pages for items that differ between the original alternative in the application, Alternative II, and the approved and permitted alternative; in other words, develop replacement and/or new plans. In most cases, this is not the development of a totally new plan, but the incorporation of new components described for that plan in a specific alternative into a similar plan contained in the permit application. When the agencies require a new plan, then Sterling would have to develop or provide the details for a new plan, which has specific requirements or design/performance criteria defined in the Alternative Description in this chapter or in an appendix. All plans for each alternative, whether expansions of old plans or totally new plans, would have to conform to the selected alternative in order to be approved by the agencies for insertion into the permit document, should that alternative be approved in the Record of Decision.

Alternative III consists of Agency-initiated modifications to the proposed action. The changes include:

- a different design for the tailings impoundment dam including agency technical panel review of the redesign;
- relocation of the intersection of Rock Creek Road (FDR No. 150) and Montana Highway 200;
- relocation of the rail siding to Miller Gulch;
- relocation of the wilderness air intake ventilation adit and investigating other options;

- modified mine portal access;
- rerouting of the utility and road (primarily FDR No. 150) corridors; and
- relocating the water treatment facility away from proposed major wetland mitigation site.

Mitigations include:

- geochemical and rock testing programs;
- rock mechanics studies;
- measures to protect scenic resources;
- changes in reclamation/revegetation plans;
- measures to reduce noise levels;
- additional grizzly bear mitigations;
- expanded monitoring for hydrology, soils and revegetation, fisheries/aquatics, and wildlife;
- a subsidence control and monitoring plan; and
- an aquatics/fisheries mitigation plan.

Alternative IV includes the mitigations and modifications from Alternative III. Additional modifications include:

- relocating mine adits and mill site, subsequently reducing utility and road corridor length.

Additional mitigations due to the mill site relocation include:

- site-specific changes in the reclamation/revegetation plan;
- a 300-foot stream buffer along the mill site;
- a visual buffer between the mill site and FDR No. 150; and
- changes to grizzly bear mitigation (replacement acreage changes).

Alternative V includes most of the mitigation and modifications from Alternative III and those from Alternative IV relating to the relocation of the mill site. Additional modifications include:

- deposition of tailings as a paste rather than as a slurry to reduce seepage to ground water, mitigate visual impacts, enhance site reclamation, and enhance stability;

- modification of the water treatment system to include semi-passive biotreatment and reverse osmosis system;
- enclosure of the rail loadout facility and use of covered railcars to minimize ground contamination and blowing of concentrate at the site and en route to smelter; and
- relocation of the evaluation adit support facilities site away from Rock Creek.

Additional mitigations developed in response to the modifications and responses to public comments on the draft and supplemental EIS include:

- burial of pipelines to reduce vandalism and visual impacts and to enhance concurrent reclamation of the pipeline corridor;
- pumping of concentrate to the rail loadout to reduce truck traffic on FDR No. 150 to reduce impacts to harlequin ducks and grizzly bears;
- busing of mine workers and visitors from a parking lot in lower Rock Creek area to reduce mine-related traffic on FDR No. 150 and reduce impacts to harlequin ducks;
- limited access to FDR No. 150B from its junction with FDR No. 150 to the paste production plant to reduce traffic immediately adjacent to Rock Creek where the 300 foot-buffer could not be established to reduce impacts to harlequin ducks;
- restricted timing for road construction/reconstruction on FDR No. 150 and 150B and hauling of waste rock to the paste facility site to avoid disturbance to harlequin ducks during the breeding and rearing season from April 1 through July 31;
- development of a site-specific reclamation/revegetation plan in conjunction with the final design for the tailings paste deposit;
- development of new water management plans and MPDES permit application due to alternate tailings disposal method;
- 1,000-foot buffer zone around Cliff Lake, north and south ore outcrops, and Moran Fault plus 450-foot vertical buffer between mine workings and ground surface;
- monitoring of cultural resources;
- development of new wetland mitigation plan due to loss of a major mitigation site (borrow site #3 adjacent to Rock Creek would not be developed); and
- changes in grizzly bear mitigation, including replacement acres and closure of 2.9 miles of FDR No. 150, instead of closing Chicago Peak Road (FDR No. 2741).

The applicant has suggested some operational changes at the Agencies' alternative mill site to improve milling efficiency. This included relocating the mine adits and portals to line up with the milling facilities and replacing the secondary crusher with a semi-autogenous (SAG) mill. These changes have been incorporated into Alternative V. Forest plan amendments to change Management Area allocations would be required for implementation of any action alternatives (see Forest Plan, Chapter 4).

PART II: ALTERNATIVES DESCRIPTION

All four action alternatives propose to amend the Kootenai National Forest Plan to establish Management Area allocations for the proposed uses. The required changes in Management Area allocation are described in Chapter 4, Forest Plan Direction for each alternative (see Appendix O).

Alternative I — No Action

Under this alternative, the applicant would not develop the Rock Creek Project. The environmental, social, and economic conditions described in Chapter 3 would not be affected by the construction and operation of the project. Any existing exploration-related or baseline collection disturbances by the applicant would be reclaimed in accordance with existing laws and permits.

The Forest Service currently does not have the authority to deny the project if the applicant demonstrates compliance with all applicable laws and regulations. National Forest System lands (NFS lands) outside wilderness are open to mineral entry under mining laws. NFS land within the wilderness are open to mineral development (generally subsurface) on lands claimed prior to December 31, 1983 and proven to be valid. Federal land policy (Minerals Policy Act of 1970) fosters and encourages the development of mineral resources in an environmentally sound manner, and ensures lands are reclaimed. DEQ may deny the application for failure to develop a plan that meets the requirements of 82-44-336 or 82-44-351, MCA; for the reasons set out in 82-4-335(8) and (9), MCA; or for failure to comply with 82-4-360, MCA. These sections of the MMRA require that permittees (1) submit adequate plans for reclamation and for air and water quality protection, (2) be in compliance at other sites they may have permitted under MMRA, (3) submit ownership and control information and (4) submit an adequate bond.

The following scenarios describe how the No-action Alternative might be implemented:

- If the Agencies determined that Sterling could not comply with all applicable laws and regulations, DEQ could deny Sterling's permit application and the Forest Service could refuse to approve the plan of operations.

  If DEQ's decision resulted in an appeal, the Board of Environmental Review would determine whether or not the project could comply with the environmental laws and regulations. If the Board determined the project could not comply with the laws, the applicant could challenge the Board's decision in court. If the court were to uphold the Board's decision, then the applicant would be prohibited from developing the mine as proposed, but it would not preclude Sterling or a new applicant from submitting a new plan of operations/permit application. Any new application would then be required to undergo a new environmental impact evaluation. If the Board or the courts determined that DEQ erred in disapproving the application, then DEQ could be required to approve the plan of operations with whatever stipulations were mandated; and the impacts would be similar to those described in Chapter 4 for the action alternative(s) that most closely resembled the Board or court ordered alternative.

If the Forest Service refused to approve the plan of operations, the applicant could appeal the decision through the Forest Service and Department of Agriculture's appeal process and/or challenge it in federal court. The resulting decision and impacts could be similar to that described for a DEQ denial above.

- The Forest Service does not have authority to acquire the applicant's property through a condemnation action. However, Congress could concurrently give the Forest Service authority through special legislation to condemn the property, forcing sale of it to the United States, and could appropriate money to pay for the purchase. Depending upon the authority used, any lands purchased by the U.S. usually have acquired status, meaning that the mineral estate is subject to leasing, not to mineral location.

- Another scenario is a willing buyer/willing seller approach. If the applicant were willing to sell, and the United States willing and able to purchase the property, a "buyout" could be implemented. Subject to some restrictions, the Forest Service has the authority to purchase lands that meet Forest Plan and national objectives. However, Congress currently has not appropriated money for the Forest Service to purchase these lands. To assist in evaluating the options to implement the No-action Alternative, the Agencies have approached Sterling to see if it would willingly sell the property to the United States, and at what price. Sterling has stated the claims are not for sale (Sterling 2001).

  Under this scenario, as provided in the 1964 Wilderness Act, Congress would have to specifically authorize the acquisition of the wilderness portion of the lands, as well as appropriate the necessary money to purchase all of the lands. Depending on the authority used, any lands purchased by the United States usually have acquired status, which means that the mineral estate is subject to leasing, not to mineral location. However, the lands could be withdrawn from mineral location.

Regardless of the actual details of implementation of the No-action Alternative, the initial result would be the lack of mine development. Chapter 4 outlines the likely effects of the lack of mine development and assumes minerals have been withdrawn from future entry. If minerals were not withdrawn from future entry, mining could again be proposed at some future date. The effects would be evaluated at the time such a proposal was submitted.

Alternative II — Sterling Project Description (Proposal)

Alternative II is the proposed action as stated in the application and plan of operations submitted to the Department of State Lands (DSL) and the Forest Service. Important highlights of the proposed exploration, operating, and reclamation plans are described below. For specific details, see the applicant's exploration and operating permit applications.

Sterling proposes to construct a 10,000-ton-per-day mine and mill complex to extract copper and silver ore from a mineral deposit underlying a portion of the CMW, about 13 miles northeast of Noxon, in Sanders County, Montana. (See figures 1-1 and 2-4.) The applicant acquired title to the minerals by using the minerals patent process of the 1872 Mining Law. The project is similar in scope and operation to the inactive Troy Mine in Lincoln County, Montana.

Ore would be initially processed in an underground crusher. The above-ground ore-processing complex would further crush and grind ore to liberate metal-bearing sulfides. Sulfides would then be removed by flotation, dewatered, and trucked to a proposed rail loadout at Hereford (also known as Noxon rail siding), and then shipped to an off-site smelter.

The entire mill complex, including surface conveyor, office building, shop, sewage treatment plant and warehouse, would be located in the West Fork Rock Creek drainage. Tailings from ore processing would be deposited in a tailings impoundment north of Montana Highway 200 near its junction with Rock Creek Road (FDR No. 150). Additional project facilities would include an access road, utility corridors, and rail siding.

The proposed permit boundary would encompass 2,422 acres, of which 584 acres are proposed to be disturbed and 1,838 would remain undisturbed (see Table 2-2). Land encompassed by the proposed permit boundary is 35 percent privately held and 65 percent NFS lands (see Figure 2-5).

Evaluation Adit

The proposed evaluation adit (see figures 2-4 and 2-6) would be driven prior to other work on the Rock Creek Project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as an additional ventilation (exhaust) opening and as a secondary escapeway, when the two adits met. Conventional mining methods would be employed for the 1-year adit construction period. Existing roads would provide access and an estimated 8.3 acres would be disturbed. More details on the evaluation adit can be found in the Rock Creek Evaluation Adit License Application (ASARCO Incorporated 1992).

The portal of the adit would be located at about 5,755 feet elevation. The adit would be 18 feet high by 18 feet wide with an estimated length of 6,592 feet at a decline of 10 percent until the mineralized zone was intersected. Forty-foot cross cuts would be driven from the adit every 500 feet to provide turnouts for vehicle passing, sump construction, and space for pump installations.

About 59,000 tons of waste rock and 119,000 tons of ore would be excavated from the proposed adit. Unmineralized or barren waste rock would be end-dumped near the portal to form a flat-topped pile sloping downhill to its angle of repose. Mineralized material would be placed in a stockpile near the portal for later processing when the mill was in operation.

Additional support facilities are proposed to be constructed for the evaluation adit. Some of these facilities would be located on 1.3 acres of Sterling property in Section 22 near the 3-mile marker of FDR No. 150. These include: an office situated in a 12-foot by 60-foot trailer or other similar structure; a dry changehouse set up in another trailer; a garage and warehouse located in a pre-engineered steel building on a concrete slab; a graded, graveled employee parking lot, and a soil stockpile.

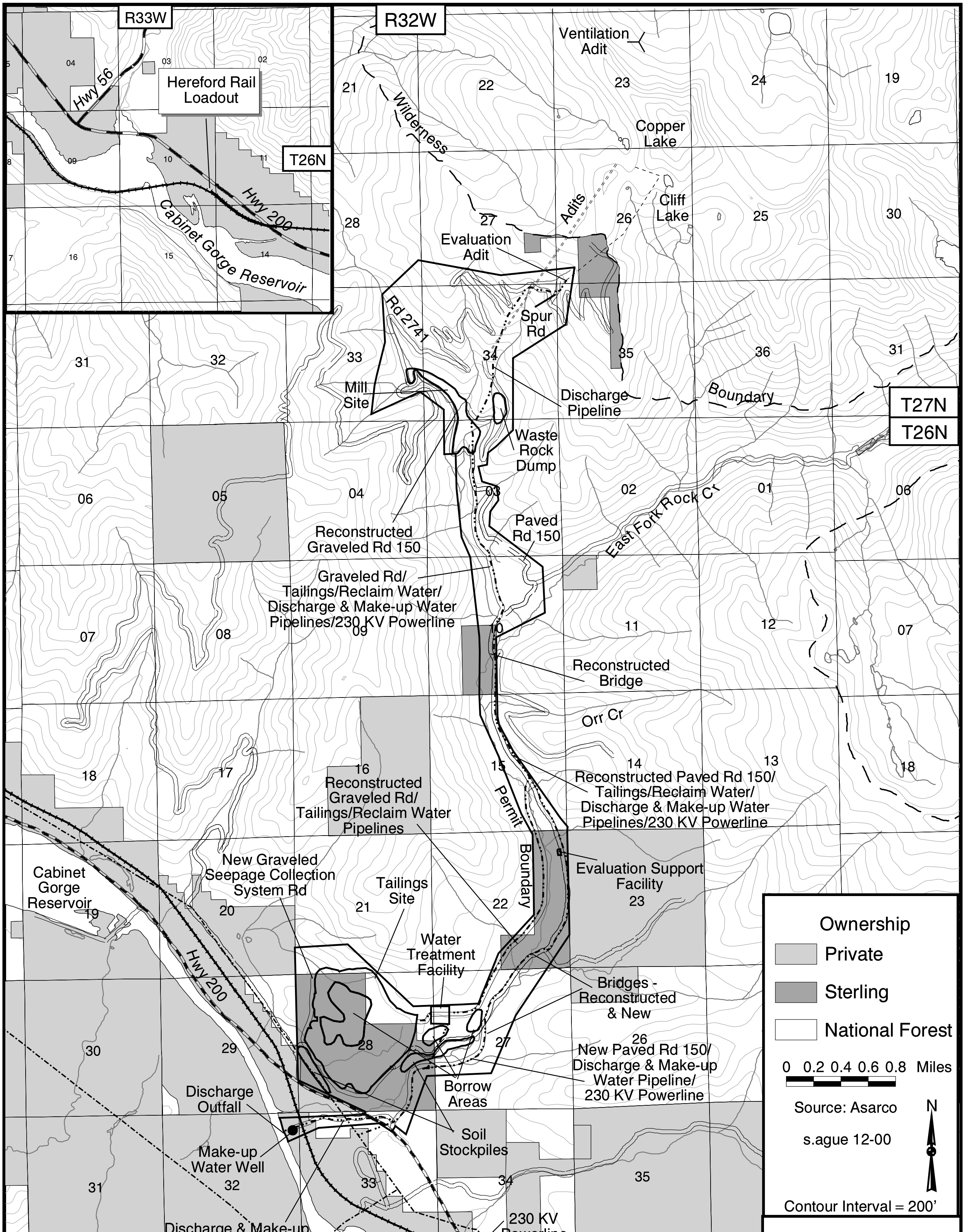


FIGURE 2-4
Alternative II
Rock Creek Project

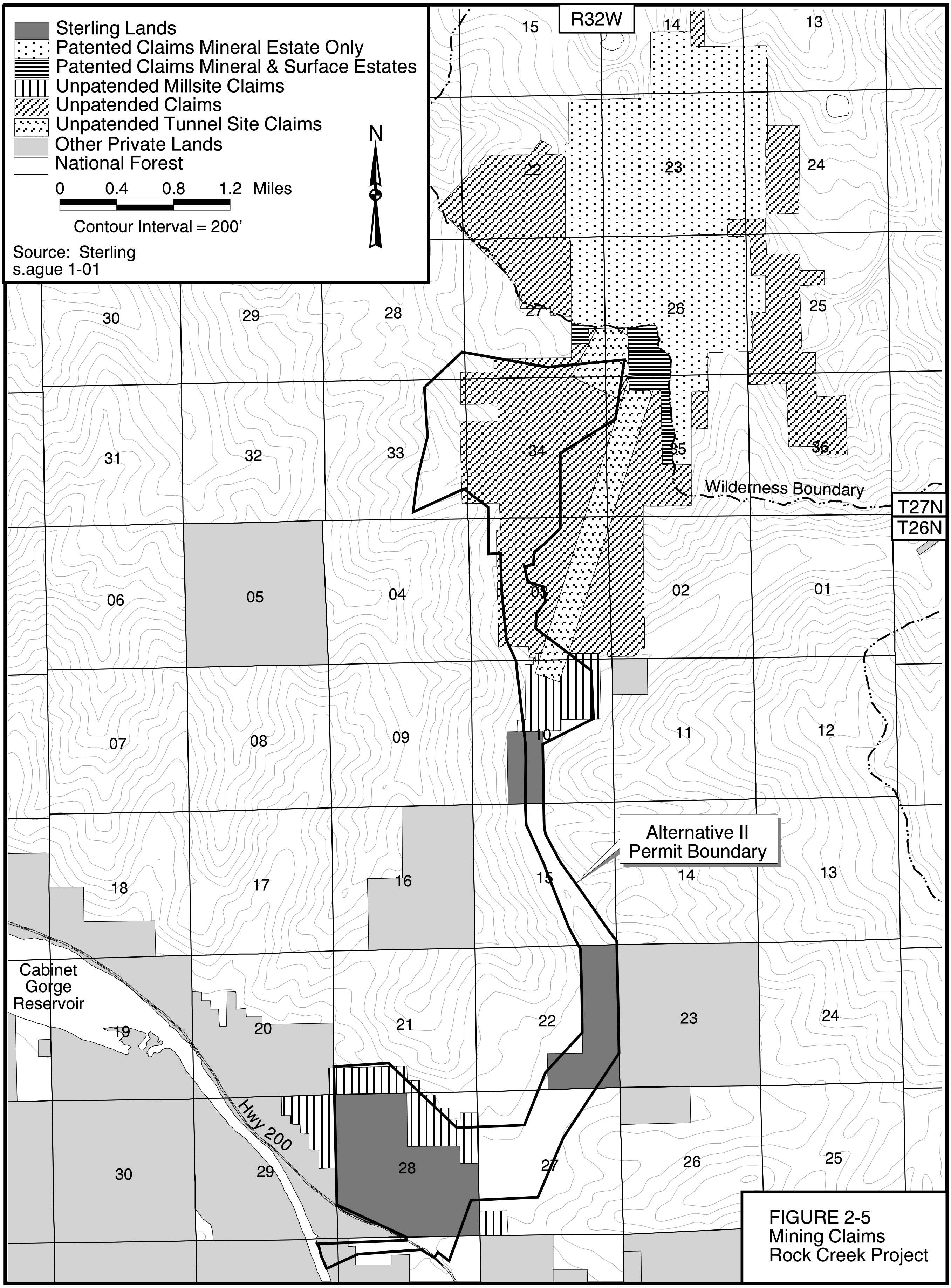
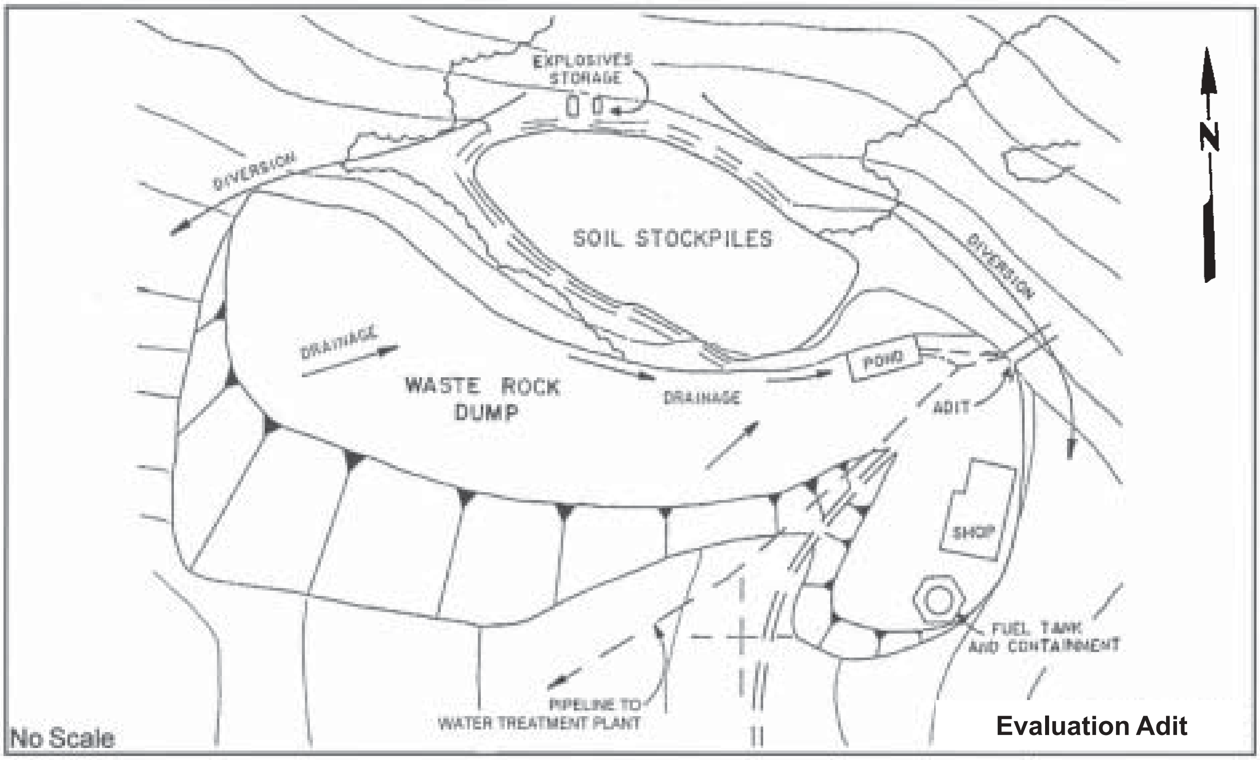


FIGURE 2-5
Mining Claims
Rock Creek Project



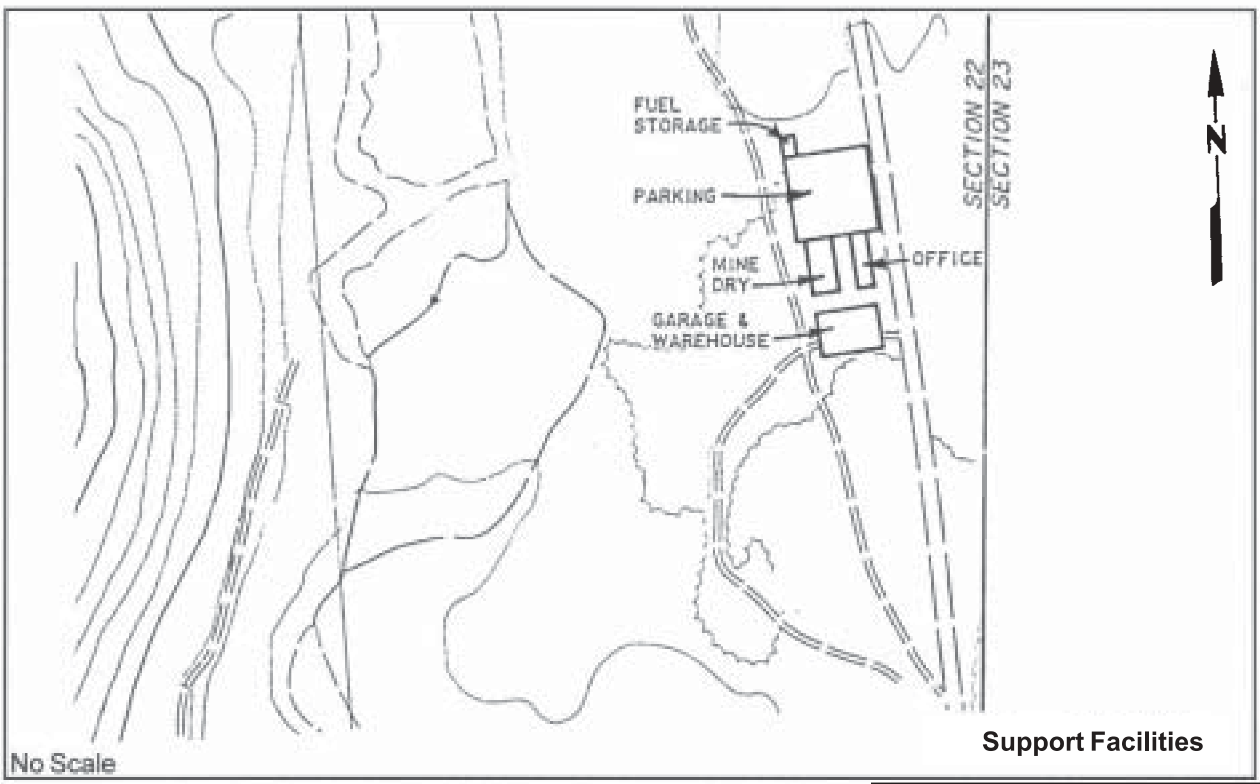


FIGURE 2-6
Evaluation Adit and Support Facilities
Rock Creek Project

Source: ASARCO, Incorporated 1992.

TABLE 2-2
Surface Disturbance Acreage (net acres impacted)[1]

Disturbance Type	Alt II	Alt III	Alt IV	Alt V
Tailings Impoundment/Deposit	**389**	**404**	**404**	**368**
Dam faces and impoundment surface	324.0	324.0	324.0	324
Borrow areas 2 and 3	27.2	27.2	27.2	0
Roads	6.6	6.8	6.8	7.9
Soil stockpiles sites	21.7	36.7	36.7	18
Water control structures	9.2	9.2	9.2	9.2
Pump station	0.2	0.2	0.2	0.2
Tailings paste plant	N/A	N/A	N/A	9.0
Transportation Corridor	**96**	**91**	**70**	**65**
Access road	36.2	43.8	36.0	35.9
Tailings line corridor	13.4	6.9	2.4	2.2
Powerline	44.3	37.9	29.8	24.2
Emergency impoundments	2.0	2.0	2.0	2.0
Fresh water well	0.2	0.2	0.2	0.2
Mill Facilities	**49**	**56**	**48**	**31**
Fenced area	40.0	40.0	47.0	30.4
New public road	1.3	8.0	0	0
Fresh water well	0.1	0.1	0.1	0.1
Water control structures	1.5	1.5	0.7	0.7
Soil stockpile sites	6.0	6.0	**	**
Water Treatment Facility	**10**	**10**	**10**	**10**
Mine	**30**	**38**	**0**	**0**
Access road	15.2	16.4	**	**
Waste rock dump	10.0	17.0	0	0
Portal area	1.0	1.0	**	**
Powerline corridor	0.8	0.8	**	**
Conveyor corridor	1.2	1.2	**	**
Air intake adit	0.1	0.02	0.02	0.02
Water control structures	0.1	0.1	0.1	0.1
Soil stockpile sites	1.5	1.5	**	**
Evaluation Adit	**10**	**10**	**10**	**8**
Mine entry patio and waste rock dump	8.3	8.3	8.3	8.3
Support facilities	1.3	1.3	1.3	0
Total Acres Disturbed	**584**	**609**	**542**	**482**

** Covered under Mill Facilities (part of "fenced area"); N/A = not applicable

[1] Total disturbance for each mine facility has been rounded to the nearest whole number.

A 500-gallon above-ground gasoline storage tank in a lined containment structure would be located near the garage and warehouse.

A few additional facilities would be located at the adit site. A 40-foot by 80-foot temporary steel shop building on a concrete slab would be constructed on top of the initial waste material removed from the adit. This building would provide warehouse space, indoor work space, a lunchroom, and lavatories. Two 500-kilowatt (kW) diesel generators would be located in a lean-to attached to this building to provide power during adit construction. A 20,000-gallon above-ground diesel storage tank in a 30,000-gallon lined containment structure would be located near the shop building at the adit site. Upon completion of the evaluation adit, all facilities would be either removed from the permit area or moved to the mill site for use during mining.

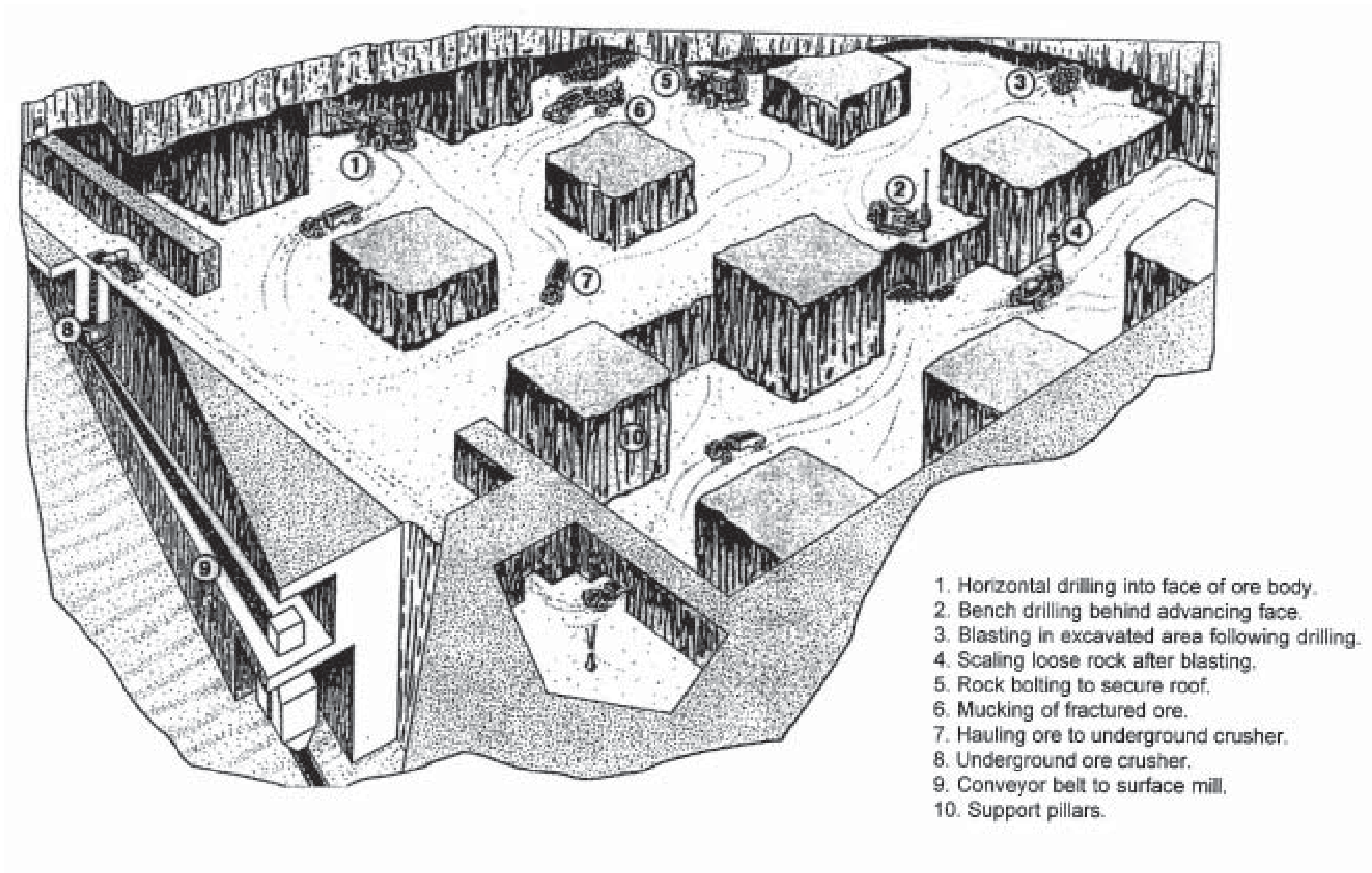
Additional facilities would be constructed to treat adit discharge and sewage (see Water Use and Management). Road construction associated with exploration is covered under Transportation. Power supply is covered under Utilities. Revegetation and soils salvage and handling are covered under Reclamation.

Mine Plan

Mine development would include driving two parallel adits directly northeast of the mill site. Adit portals are proposed outside the wilderness boundary (see Figure 2-4). The north adit would be used as a conveyor adit and the south as a service adit for mine access. A level working area at the portal would be constructed by cutting into the hill to create a vertical face for adit construction. Adit size is dictated by ventilation requirements and dimensions of mining equipment. Each adit would be 25 feet wide by 20 feet high. The two parallel adits would be driven uphill concurrently at a grade of 12.7 percent about 9,000 feet to the site for the underground primary crusher.

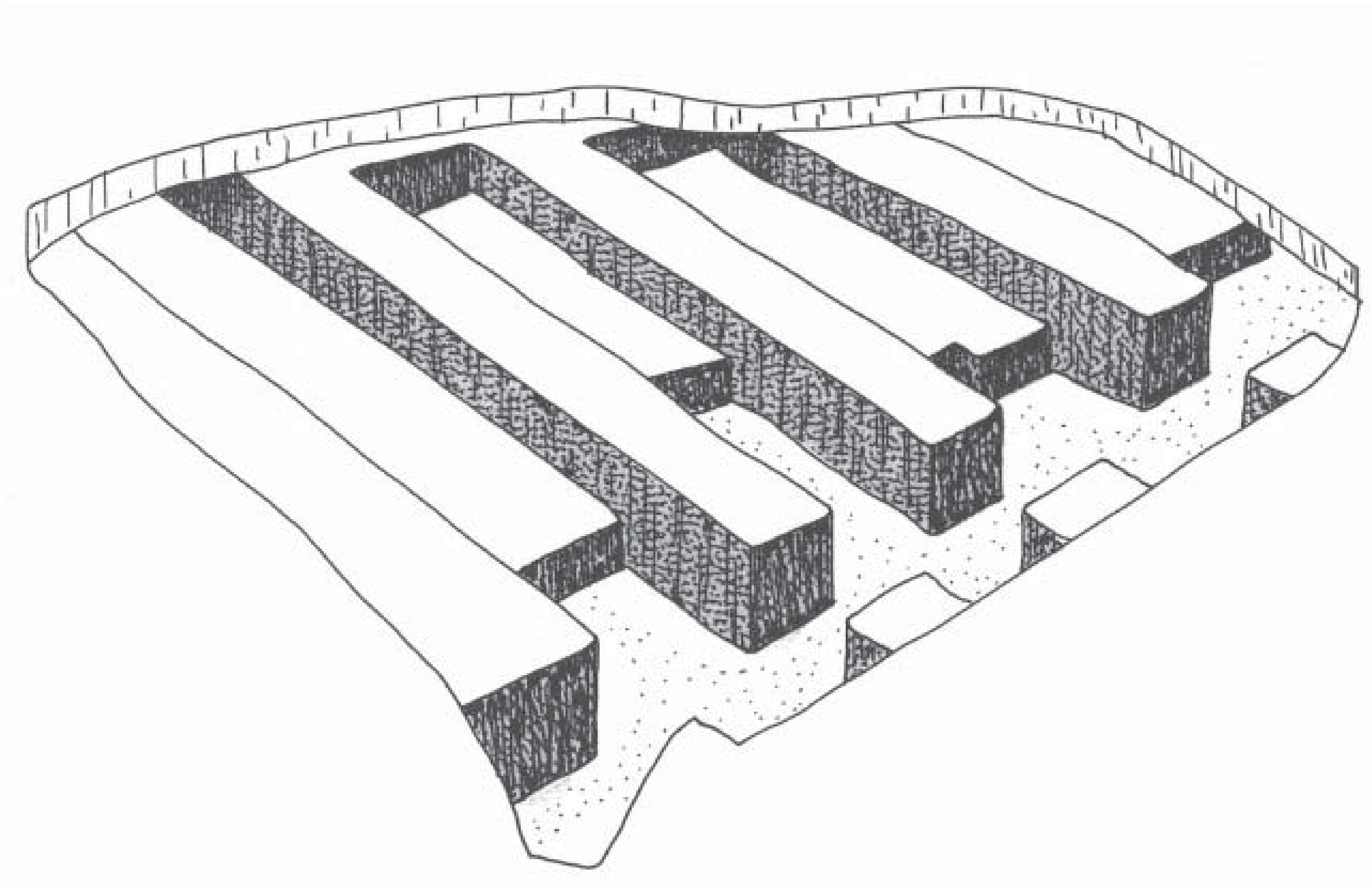
Electric ventilation fans would initially use the conveyor adit for intake and the service adit for exhaust. However, the evaluation adit would be used for primary exhaust removal when the underground workings reached it. If in the future, monitoring shows a need to provide additional ventilation for mine personnel health and safety as required by the Mine Safety and Health Administration (MSHA) rules and regulations, it may be necessary to drive an adit to the surface in the wilderness to provide an additional air intake and a secondary escapeway from the mine. The air intake ventilation adit would be driven from the underground workings; there would be no need for the creation of a waste rock dump at the adit portal in the wilderness. Fans would be located no closer than 200 feet underground from the wilderness adit opening. The applicant would contact the Forest Service prior to construction for approval of final siting and construction methods.

The room-and-pillar system of mining is used for most flat-lying or nearly flat-lying ore deposits where the ground is hard and firm, and where artificial means of support would be too costly. Room-and-pillar is one of four common types of open stope (underground excavation) methods. In room-and-pillar mining, some ore is left unmined to give support to the mine roof (see Figure 2-7). The slot-pillar system is similar to room-and-pillar. Rather than a regular pattern of rooms and square pillars, a slot pillar is longer in one direction, creating a system of rectangular pillars and rooms (see Figure 2-8). This design is used when more ground support is needed. Generally, a regular pattern of pillars is more efficient than an irregular one, and the size and spacing of support pillars varies depending on local



SOURCE: Dames and Moore Underground Mining 1994.

FIGURE 2-7
Room and Pillar Method
Rock Creek Project



SOURCE: Dames and Moore Underground Mining 1994.

FIGURE 2-8
Slot Pillar Method
Rock Creek Project

ground conditions (Earll et al. 1976). Sterling proposes to use a combination of room-and-pillar and slot-pillar designs.[1] The majority of the mine layout would use a regular pattern of rooms and pillars. A design layout similar to Sterling's Troy Mine is proposed. The determination of when to use a regular pattern versus a slot pillar approach would be made after examining local ground conditions and rock mechanics data.

In order to protect against surface subsidence, Sterling proposes to leave a minimum 100 feet of overburden between any working area and the ground surface. This limit would be modified based on site-specific information gathered as a result of the ongoing mining operation.

In the Copper Lake Fault area where ore thicknesses exceed 100 feet, Sterling proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

In areas where the proposed ore extraction thickness exceeded the capacity of designed pillars, Sterling proposes to use a horizontal pillar to facilitate extraction over the entire ore height. A horizontal pillar is a section of unmined material left in place between two rooms stacked one on top of another (see Figure 2-9). Using a design from the Troy Mine, Sterling expects to use this approach when ore thicknesses exceed 75 feet.[2] Although ore recovery is reduced to 52 percent from 75 percent using this design, it would allow for ore extraction over the entire ore column.

Conventional drilling, blasting, rock bolting, and mucking methods would be used underground. Broken ore would be processed by an underground crusher and then transported to the surface via conveyor belt for further processing. A surface conveyor belt would transport ore from the adit portal to the mill. During project construction, an estimated 600,000 tons of waste rock would be produced. A portion would be used as fill for the mill site and as construction material for the tailings impoundment, while the remainder would be placed in a hillside waste rock dump (see Figure 2-10).

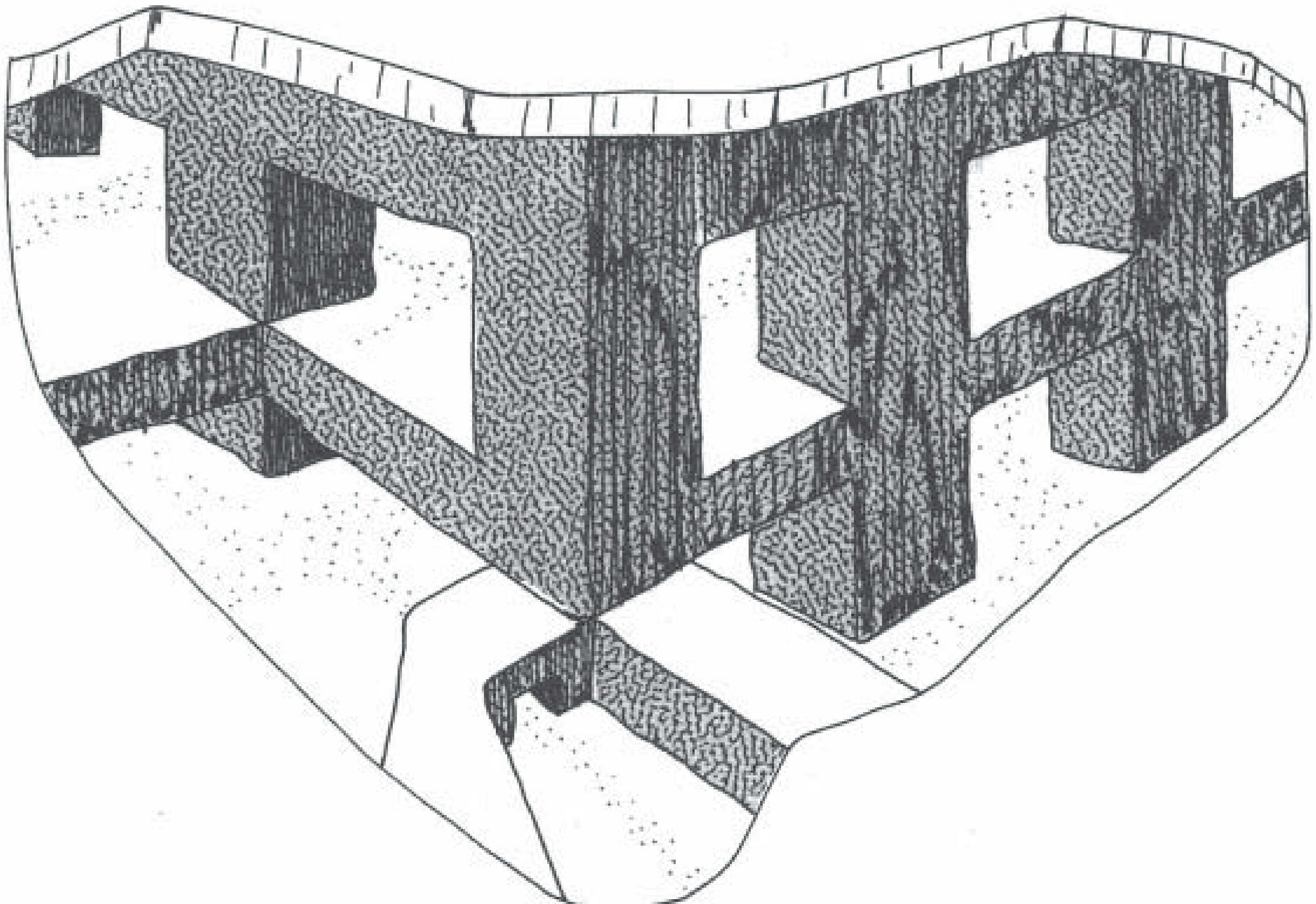
A maximum of 2,500 cubic yards of ore mined during the construction period would be stockpiled at the mill site for treatment following construction of mill facilities. Waste rock generated underground during the production period would be stored in mined-out areas. Residual waste from ore processing would be disposed above-ground in a tailings impoundment.

Seasonal storage of mine water within underground mine workings is proposed to regulate outflow through the water treatment system. By year 27, a 207.7-million-gallon reservoir would be established in worked out portions of the mine to handle maximum water storage requirements. This would equate to a maximum storage capacity of about 64 acres with water 10 feet deep. The area and

---

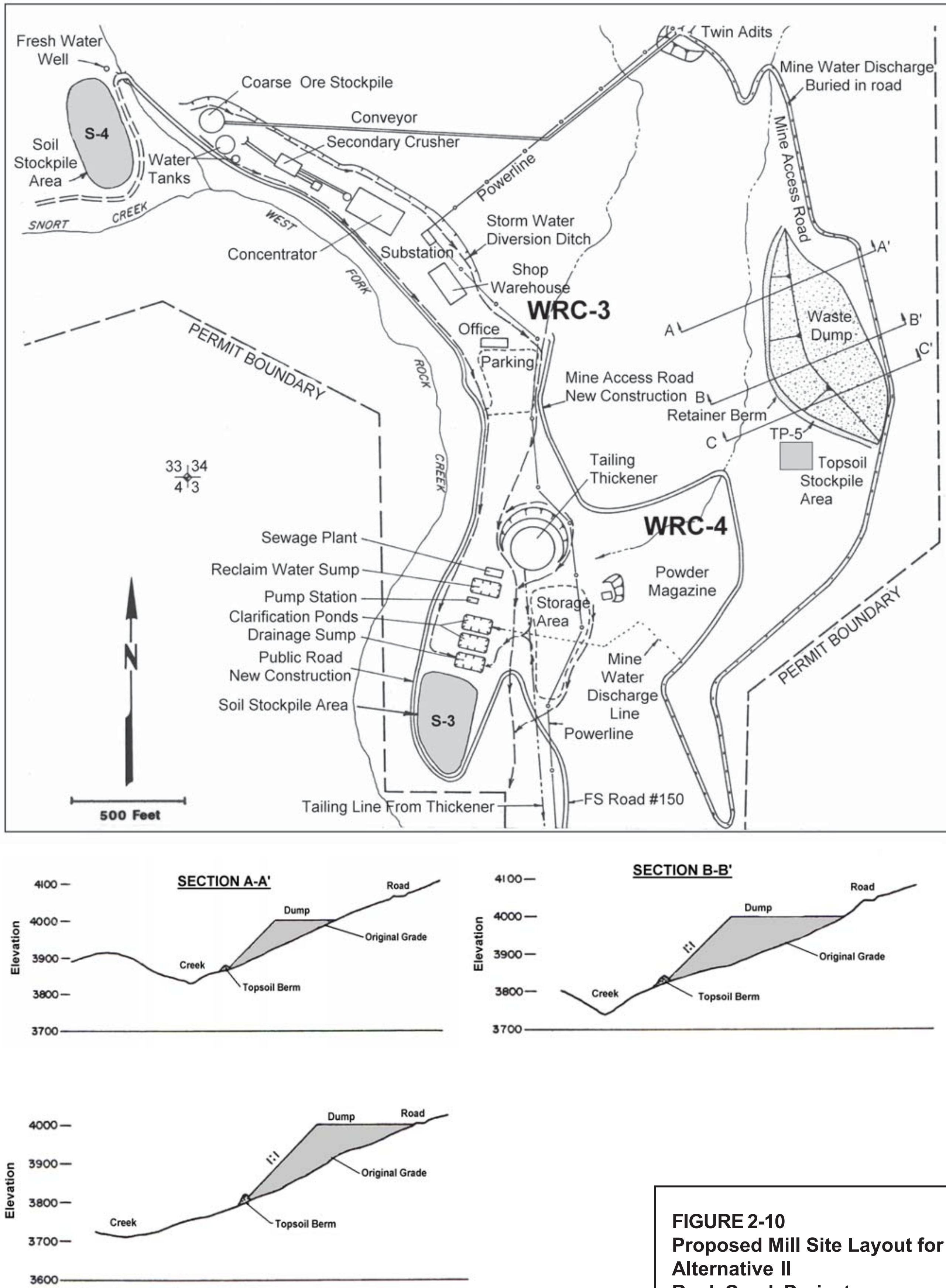
[1] The pillars would be 45 feet square and drives and cross-cuts 45 feet wide. Ore recovery is projected at 75 percent. As ore thickness increased and/or overburden decreased more ground support may be necessary. Again, using a design from the Troy Mine, Sterling proposes to use a slot-pillar approach. The pillars would be 30 feet wide while the drives would be 50 feet wide. The overall length of the slot pillar would vary but could be on the order of several hundred feet long. Ore recovered using this approach is reduced (10 percent at Troy Mine), however ground support is improved.

[2] Vertical pillars would be 30 feet wide, rooms 50 feet wide, and the horizontal pillar 40 feet thick. In this manner a 200-foot thick ore horizon could be mined with two 80-foot-tall rooms with the intervening 40-foot horizontal pillar.



SOURCE: Dames and Moore Underground Mining 1994.

FIGURE 2-9
Thick Ore Zone
Room and Pillar Method
Rock Creek Project



SOURCE: ASARCO Inc. Permit Application, 1992

FIGURE 2-10
Proposed Mill Site Layout for Alternative II
Rock Creek Project

volume required for storage would be increased throughout the mine life on an as-needed basis. The storage areas would be mined using conventional methods except that barrier pillars would be left in place along either side of the storage area.

Surface Disturbance

Surface disturbance would result from construction and maintenance of the tailings impoundment and associated components, transportation corridor, mill facilities, water treatment facility, mine, and evaluation adit (see Table 2-2). A total of about 584 acres would be disturbed within the permit area. The Forest Plan would be amended to change the management area allocation on 201 acres to make it consistent with the intended use.

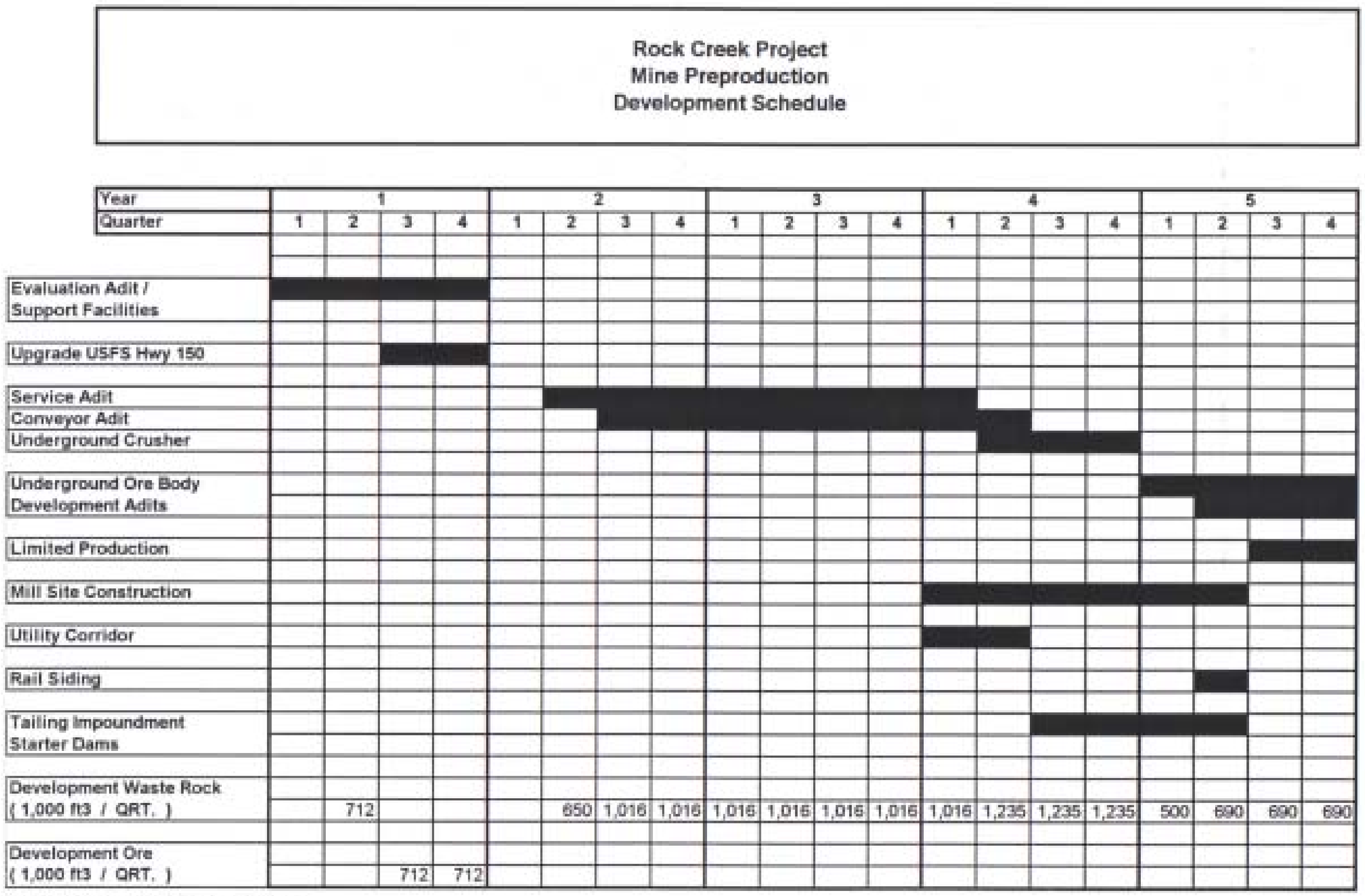
Less than 3,000 square feet of surface would be affected by the air-intake ventilation adit in the wilderness area. Since this opening would be driven from inside the mine to the surface, very little (no specific quantity provided by the applicant) waste rock would be deposited on the surface at the opening; the disturbed area would be limited to the opening itself. The opening would be covered by a tamper-resistant grate.

Ore Production Schedule

Sterling would develop an underground mine that would produce 10,000 tons of ore per day, or 3.5 million tons per year. Ore reserves are estimated to range between 136 and 144 million tons averaging 1.65 troy ounces per ton of silver and 0.68 percent copper. Sterling's more recent estimate puts the ore body at 136 million tons. The applicant originally estimated a 75 percent extraction rate. However, based on the applicant's more recent mine design, about 65 percent of the ore body would likely be mined, with about 35 percent remaining as pillars and other structural support. Actual underground conditions would govern the amount of ore removed.

Based on these figures, Sterling would mine and mill between 88 million tons and 108 million tons of ore giving the mine an anticipated production life of 31 to 37 years. Based on milling efficiencies at the Troy Mine, the applicant anticipates a milling efficiency of 85 percent. That is, about 85 percent of the copper minerals and silver in the mined ore would report to the concentrate while 15 percent would remain in the tailings.

Sterling anticipates a 1-year period for constructing the evaluation adit in addition to a 3-year period for mine construction and development with one-half year of limited ore production (see Figure 2-11, and Table 2-11 in the Alternative IV description). Full production would begin after that and is estimated to last up to 30 years. The full production life would depend upon metal prices, engineering, and other factors that determine financial viability. Postmining reclamation is estimated to last 2 years (after the tailings impoundment surface dried enough for reclamation activities). This would result in a total project life of 31 to 37 years depending upon the actual amount of ore and the ore extraction rate.



SOURCE: ASARCO Incorporated 1995.

FIGURE 2-11
Mine Production Development Schedule
Rock Creek Project

Ore Processing and Shipping

The ore-processing facility would consist of an underground primary crusher, an above-ground secondary crushing plant, concentrator, tailings thickener, drainage sumps, pumps and slurry and water pipelines. An office building, changing rooms and showers, and shop warehouse also would be located at the mill site. The ore-processing plant would operate 7 days per week, about 354 days per year for a total processing capacity of 3.5 million tons/year.

The milling process involves five major steps; crushing, grinding, flotation, concentrate dewatering, and tailings storage. Figure 2-12 illustrates the steps used in ore processing. Crushing, grinding, and flotation would produce tailings and a single concentrate containing both copper and silver. Chemical reagents[3] would be added during the flotation process to separate the ore concentrate from the tailings (see Appendix I). Concentrates leaving the flotation process would be pumped to a concentrate thickener where a portion of the water would be removed for reuse in the mill. After further dewatering, concentrates would be deposited in a bin from which they would be loaded into haul trucks for transport to the Hereford rail loadout (see Figure 2-4). Some reagents would be disposed with the tailings and some would remain in the ore concentrate.

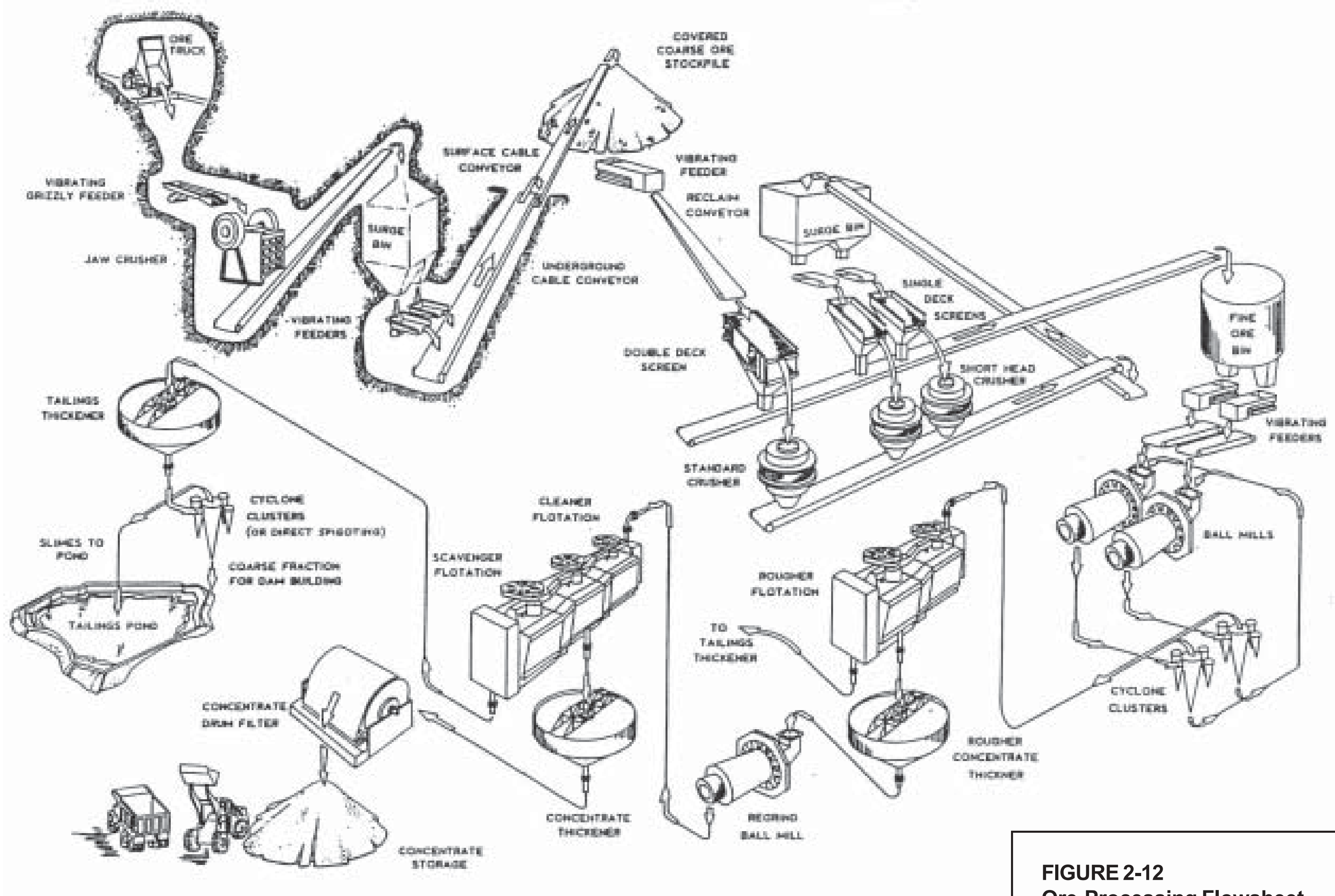
Tailings from the milling process would go to a 250-foot diameter tailings thickener. Water in excess of that needed to move the tailings to the impoundment in twin slurry pipelines would be removed for reuse in the mill.

About 51,000 tons of concentrate per year (about 1.4 percent of mined ore) would be trucked 13 miles to the Hereford railroad loadout via FDR No. 150 and Montana Highway 200. Concentrate would be hauled 8 a.m. to midnight, 7 days a week. From the junction of FDR No. 150, the rail siding is about 6 miles northwest at Hereford via Montana Highway 200, then 0.25 mile over a graveled county road. The existing rail siding location runs east and west perpendicular to the county road. The track is in good condition. No initial capital investment of track was anticipated by the applicant. However, Montana Rail Link has determined that about $144,000 of initial capital investment in rail track would be required. Sterling proposes to construct a concentrate hopper/conveyor at the west end of the Hereford siding. The facility would include a drive-over ramp with a hopper located in the center. The end-dump trailer would dump into the hopper, which would have a capacity of about 40,000 pounds.

The concentrate would be loaded immediately into a rail car. Rail cars would be loaded six to eight times every 24 hours. Sterling intends to negotiate a freight agreement calling for the removal of loaded rail cars three times per week. The railroad would determine actual days for loaded rail car removal.

---

[3] A variety of reagents would be used in ore processing. These would include Xanthate, Yarmor-F Pine Oil, Dow 250, Superfloc S-5595, and Orzana A. Appendix I lists the reagents, physical characteristics and toxicity of each reagent, the addition points in ore processing, and the estimated annual consumption.



SOURCE: ASARCO Incorporated Permit Application 1992.

FIGURE 2-12
Ore-Processing Flowsheet
Rock Creek Project

Tailings Impoundment

Impoundment Construction. The proposed tailings impoundment location is about 3 miles southeast of Noxon, northeast of Montana Highway 200, near the confluence of Rock Creek and the Clark Fork River (see Figure 2-13). The majority of the impoundment would be located on ASARCO's private land (255 acres) in Section 28, T26N, R32W, bordering NFS lands to the east and north. The impoundment area ranges in elevation from 2,360 to 2,700 feet. The impoundment eventually would fill to the point that about 69 acres of adjacent NFS lands would be covered.

The proposed tailings impoundment would be constructed using the upstream method (see Figure 2-3). It would be designed to contain the estimated 100 million tons of tailings to be produced over the 30-year mine life. Details of the design are presented in *Preliminary Design Study Tailings Disposal System* (Dames & Moore 1993). The dam is designed to withstand a 7.0 magnitude earthquake occurring on the Bull Lake Fault. Engineering aspects of the design are discussed in Appendix G.

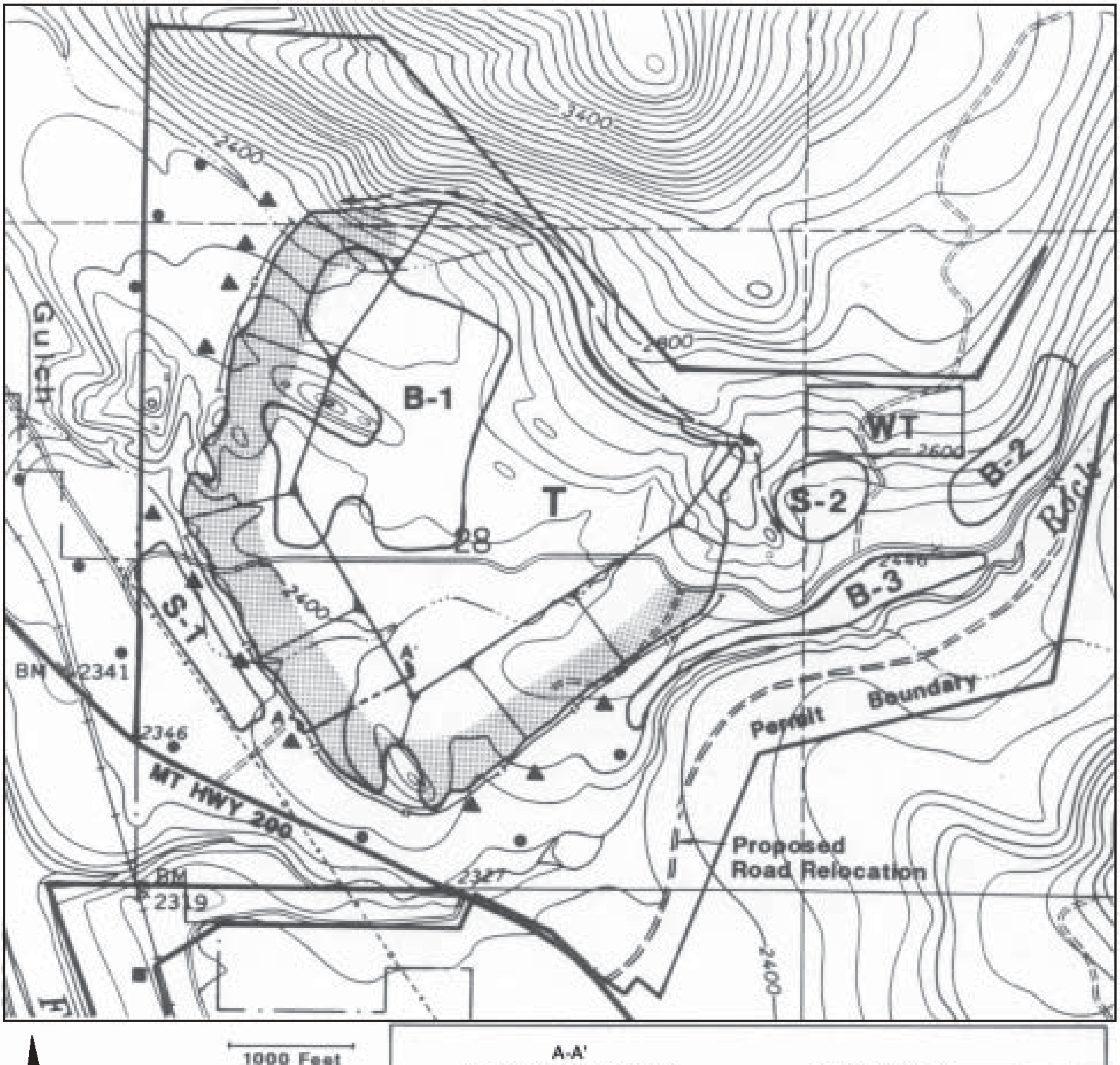
The tailings impoundment design is preliminary and would be modified as additional information was obtained. The Agencies would provide a technical review of the final design and possible future revisions to ensure conformity with design goals.

The impoundment would require construction of a perimeter embankment on the downhill sides of the facility. Initial starter dams would be constructed with nearby borrow materials and waste rock. These dams would provide tailings storage during initial stages of operation. The perimeter tailings embankment would be constructed, shaped, and maintained using earth-moving equipment.

Due to topographical features of the area, two initial impoundments constructed from borrow material would be operated, referred to as "primary" and "secondary" areas. Embankments would be incrementally raised with sand tailings to provide additional storage capacity, using the conventional "upstream" method of construction. With this method, the crest of the expanding embankment section is progressively shifted upstream of the original starter dam crest. As embankments increase in height, the two impoundment areas would join, forming a single storage facility ultimately covering 324 acres. In order to provide sufficient capacity for mine life, the embankment would be raised about 325 feet, as measured from the toe of the embankment, to an ultimate elevation of 2,685 feet.

Tailings Disposal. Tailings slurry from the thickener would be transported above-ground via twin 10-inch, urethane-lined, steel pipelines about 4.7 miles to the impoundment for disposal. Excess water from the tailings impoundment would be pumped a similar distance back to the mill for reuse as make-up water via a buried 12-inch steel reclaim line. All lines would be encased in a larger steel pipe at creek crossings to guard against spillage. Small emergency dump impoundments (ponds) would be provided in critical areas along the pipelines, such as prior to stream crossings, to contain potential spillage.

The proposed method of material segregation (separating the sand fraction from the slimes) and placement (depositing the materials in the impoundment) is described in Appendix G.



T - Tailings Impoundment
B - Borrow Area
S - Topsoil Stockpile
WT Water Treatment Plant
● Groundwater Compliance Monitoring Well
▲ Groundwater Capture Well
Perimeter Trench
Underdrain System
Permit Boundary
■ Make-up Water Well
Diversion Ditch
BPA 230 kV Powerline

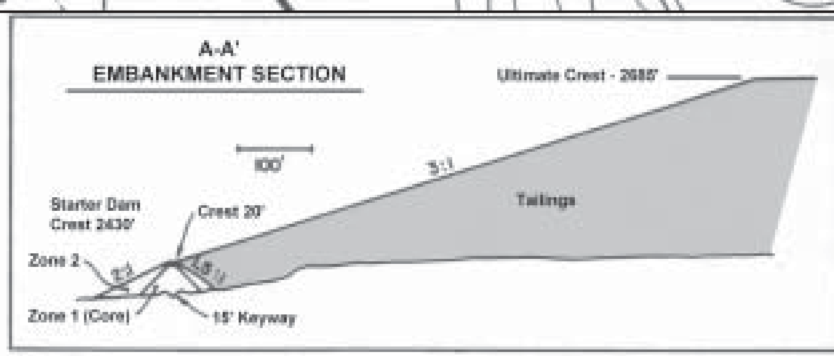


FIGURE 2-13
Proposed Tailings Impoundment
Rock Creek Project

Tailings Impoundment Seepage

Embankment Drainage. For stability purposes, it would be necessary to control the seepage of water from within the impoundment outward through the embankment. The general goal is to intercept the water before it seeps from the downstream face of the dam. For this reason, embankments are designed to provide preferential seepage paths to direct the outwardly flowing water into drainage collection systems from which it would be pumped back into the impoundment. This would involve placing the sand fraction of the tailings (free-draining material) along the base and upstream face of the starter dam. These drains would be connected to a series of pipe drains to route the intercepted drainage to collection stations from which it would be pumped back into the impoundment. These drains, combined with the sandy zone created by the 200-foot-wide beach, are intended to direct outward seepage to the drainage systems and prevent it from exiting on the face of the dam.

Tailings Impoundment Seepage. Seepage from the impoundment to underlying ground water would be contained by use of a seepage collection system that would include impoundment underdrains, perimeter trench drains, and ground water capture wells (see Figure 2-13 and ASARCO Incorporated 1995a). Water from the underdrains and perimeter trench drains would enter a perimeter collection system adjacent to the main embankment and would be returned to the impoundment. A secondary system of capture wells is proposed to intercept seepage that would pass the perimeter trench drains. A third system of ground water monitoring wells would be used to monitor seepage collection system performance and potential exceedence of established trigger levels.

The perimeter trench drain system would penetrate to bedrock in areas where bedrock was within approximately 20 feet of the surface. Design details for the perimeter trench drain system would be developed as part of subsequent geologic and geotechnical investigations associated with the detailed design of the impoundment and would be modified based on depths to bedrock around the impoundment perimeter. Where possible, the perimeter trench drain extending to bedrock would form a cutoff barrier for ground water migration. Where the trench drain could not extend to bedrock, seepage would bypass the trench drains and migrate toward the ground water capture wells.

The system of capture wells downgradient of the perimeter trench drain system would intercept ground water prior to leaving the permitted mixing zone, and return it to the impoundment. Capture wells would be located approximately 200 to 300 feet beyond the toe of the tailings impoundment embankment. Figures 2-13 and 2-14 show the conceptual plan for the location of 11 pairs of ground water capture wells and ten downgradient monitoring wells. Additional geotechnical drilling to support the final design plans for the perimeter seepage collection system would determine the final design, number of wells, depth of completion, spacing, and pumping rates for each of the wells in the capture well system.

After mine closure, tailings impoundment seepage would continue and diminish with time. It is estimated that the tailings impoundment would drain for several decades before reaching a steady-state condition. Some of the water from the capture wells would be used for revegetation irrigation. The seepage collection system would continue to operate until seepage met all water quality criteria and standards.

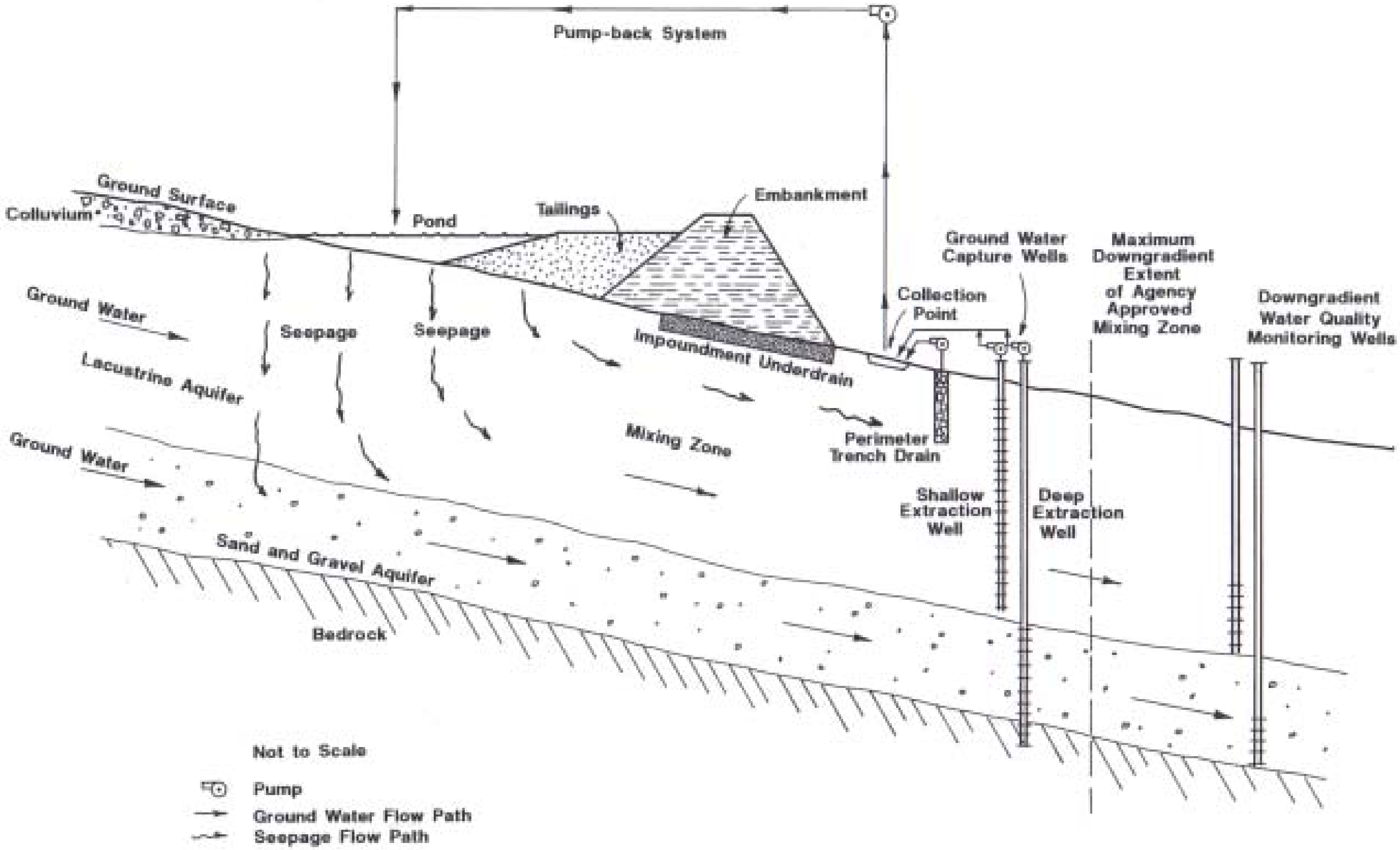


FIGURE 2-14
Conceptual Layout for Impoundment Seepage Collection System
Rock Creek Project

Storm Water Control

The tailings facility has two storm water control design elements: (1) diversion structures to route storm runoff from outside of the immediate impoundment area around the tailings facility (see Figure 2-13), and (2) containment within the impoundment of storm water that would fall directly in the tailings facility. The diversion structures are designed to convey the calculated probable maximum flood (PMF). The impoundment could also contain the PMF resulting from direct precipitation into the impoundment area, however, due to its construction sequencing, this storage would require pond encroachment on the tailings beach until about year 3 of the structure's life (Chen-Northern 1990).

Water Use and Management

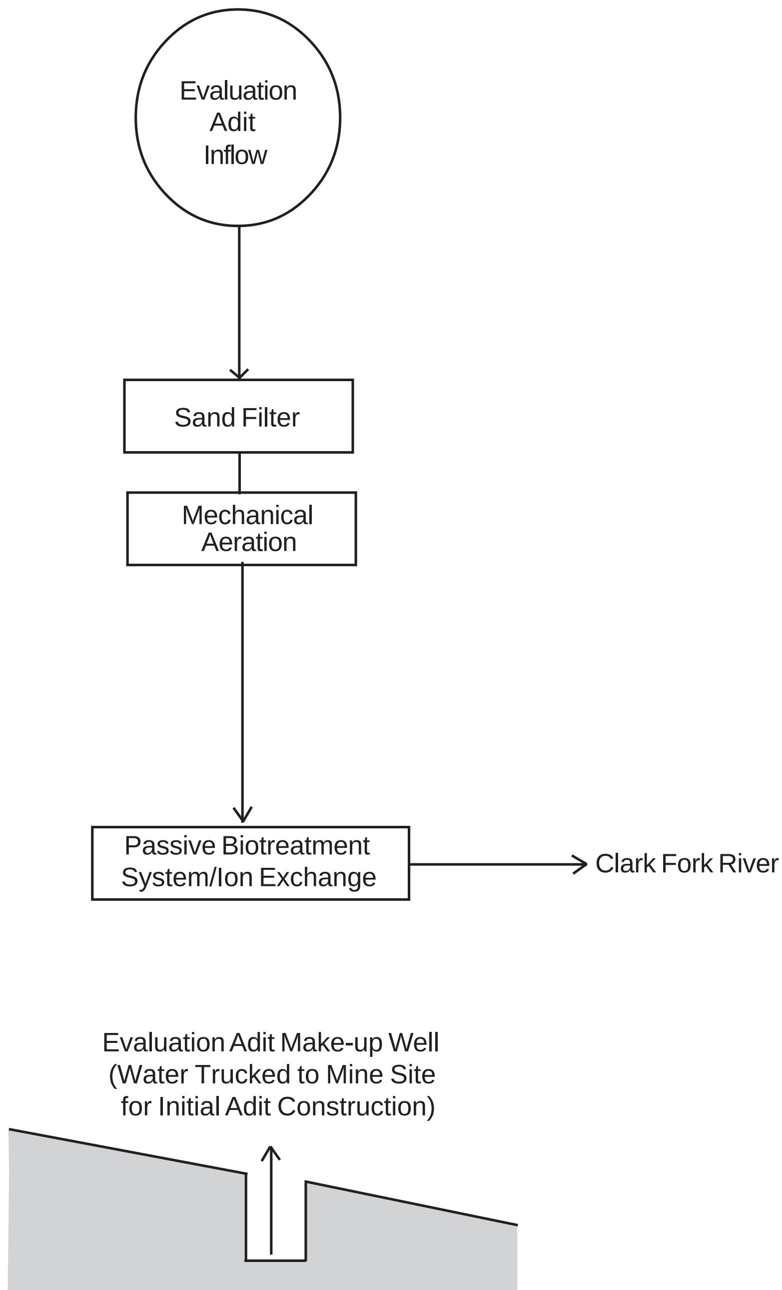
Evaluation Operation Requirements. Water requirements for driving the evaluation adit would average 30 gallons per minute (gpm) during the drilling cycle. Additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop.

Water for drilling would initially be hauled to the site from a makeup water well at the confluence of Rock Creek and the Clark Fork River (see Figures 2-4 and 2-13). A lined pond, with a capacity of about 30,000 gallons, would be constructed near the evaluation adit portal to collect site runoff and store the hauled water. A barrier would be erected around the pond to exclude wildlife. A diversion berm would be constructed above the portal and soil stockpile to divert natural runoff around disturbed areas (see Figure 2-6).

A pump in this pond would provide water for drilling during the initial adit construction phase. Excess water encountered in the adit during this phase would be pumped to the pond. After the adit had advanced approximately 350 feet, an 18-foot by 18-foot by 40-foot (97,000-gallon) mine sump would be excavated to function as the evaluation adit water sump. An oil skimmer and pressure filter would be located at this sump to remove oils and grease and suspended solids from the water supply.

Excess water from the adit sump and pond overflow would be pumped through a temporary 6-inch polyethylene pipeline to a biotreatment system and an ion exchange treatment plant for treatment prior to discharge. Discharges must comply with MPDES limits (see Figure 2-4). The temporary pipe would be removed when the mine reached the evaluation adit. Once the evaluation adit is incorporated into the mine workings, evaluation adit water would be routed through the mine water drainage and collection system described below. See Figure 2-15 for a schematic diagram of water handling for exploration. Characteristics of the passive biotreatment system are discussed in detail in the following section (mine operation requirements).

Potable water would be trucked to the adit site and stored in a tank in the shop until a suitable source was found in the adit. Two wells would be installed to supply the support facility. Sewage from the lavatory in the adit shop, and from lavatories in the office and the mine dry at the support facility would drain to conventional septic tanks and drainfield systems. If, according to DEQ, either or both of the proposed sites or their alternate locations were not suitable for a drainfield, then a holding tank would be installed. This tank would be pumped periodically and hauled to a municipal sewage disposal facility (ASARCO Incorporated 1992).



SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-15
Schematic Diagram of Water Handling (Exploration)
Rock Creek Project

Mine Operation Requirements. Figure 2-16 provides a schematic diagram of project water handling for mine operation (years 10 and 23). Table 2-3 provides additional water balance detail. During full production, the mill would require 3,131 gpm of process water. This water may come from one or more of the following sources: mine adit water, a make-up water well, waste water from sewage treatment, mill site runoff, thickener overflow, and reclaimed water from the tailings impoundment. During mill operation, make-up water would be required to supplement water recycled from the tailings thickener. Because the amount of mine water discharge and available reclaim water from the tailings impoundment would vary seasonally, a make-up water well has been planned in the Clark Fork River alluvium capable of supplying full make-up water requirements. The location of this proposed well near the confluence of Rock Creek and the Clark Fork River is shown on Figure 2-4. A buried 12-inch steel pipeline would connect to the reclaim water line thus carrying water to the mill.

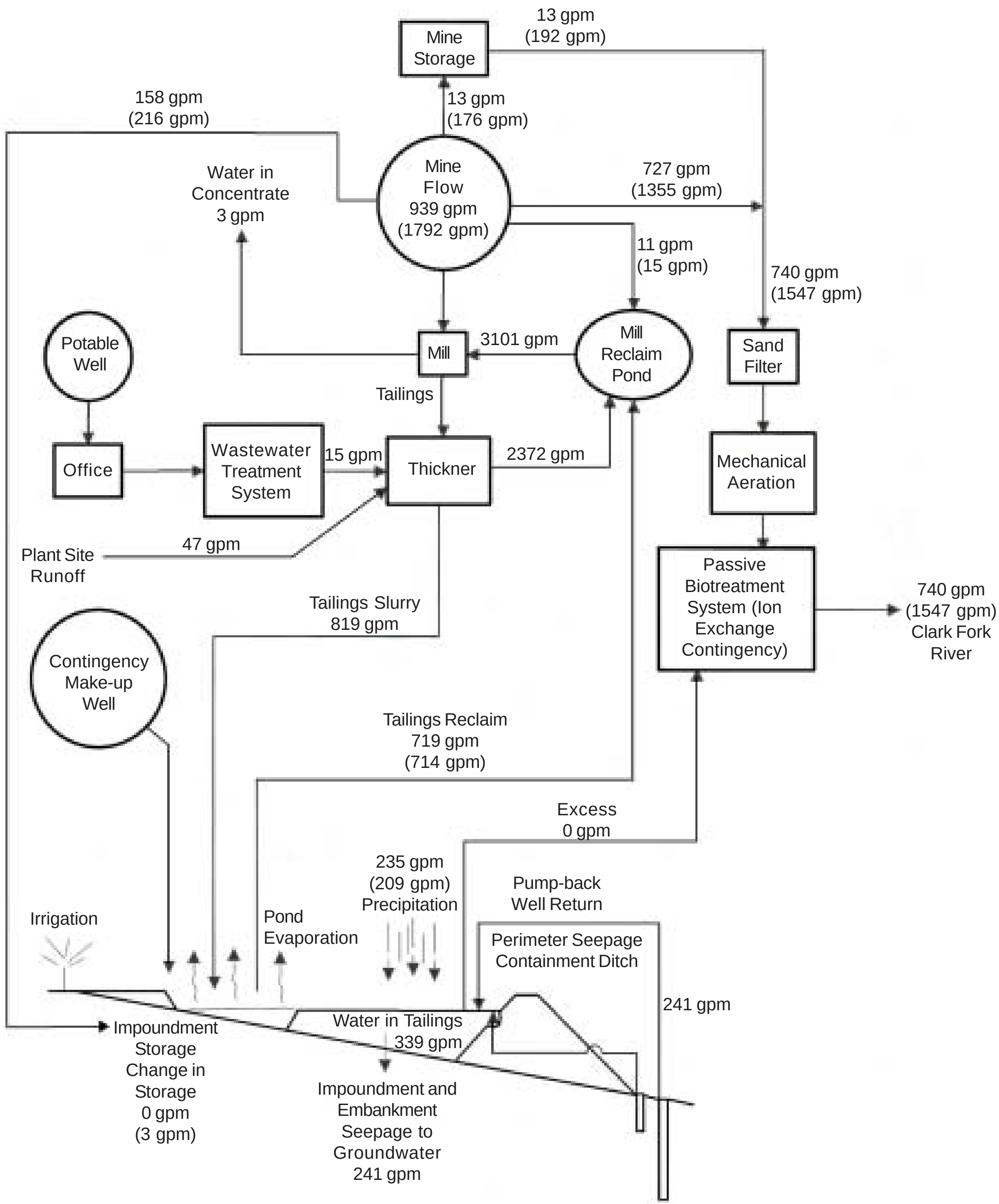
By the end of mine operation, up to 207.7 million gallons of mine and adit water potentially would require storage in an underground reservoir. This reservoir could require a 64-acre pond 10 feet deep. Excess water would be held in or released from storage depending on the available storage in the tailings impoundment pond and the available capacity of the passive biotreatment system. For example, should a problem develop with the mine water treatment system, excess mine water could be stored in the mine for a short time until the problem with the water treatment system was corrected. During the wet season, excess mine water would likely be stored underground. During the dry season, stored water would be released and directed to the water treatment system. A plan view and cross-section of the potential underground water storage area are provided in Figure 2-17.

Mine effluent typically would be expected to contain high concentrations of suspended solids at a relatively neutral pH and an undetermined concentration of some dissolved metals. This would contribute a significant portion of the total metals load to mine effluent. Initial removal of suspended solids would be accomplished using two 100,000-gallon mine sumps to settle out the solids, by adding chemicals to flocculate (clump) the particles if necessary, and subsequent filtration. Water would be pumped from the mining face to these sumps for the main mine water supply.

Water originating within the mill site also would be collected and routed to a drainage sump at the mill site for use as process water. Water filters and an oil skimmer would be located in the mill area to remove suspended solids and oil and grease from the water supply. Filter backwash would be sent to the tailings thickener. Filtered water from mine and mill sumps in excess of the requirements for mine development and mill make-up water would flow through a buried 12-inch polyethylene pipeline to the water treatment facility before discharging to the Clark Fork River.

Additional settling of suspended solids would occur within the tailings impoundment. Flow would be regulated to allow sufficient settling time to remove solids within the pond on the impoundment. Excess water would be discharged through a clarifier and sand filtration unit before being routed to the water treatment system for nitrate removal.

Water treatment and effluent discharge to the Clark Fork River would meet effluent limitations in accordance with an MPDES permit from DEQ. The scenario, including other elements of the project's water balance, is illustrated in Figure 2-16 (for mine operation years 10 and 23). Water balance at the tailings impoundment would fluctuate seasonally. Decreases in water available for mill operations would be replaced by mine water, reclaim water from the impoundment, and/or makeup water as required.



LEGEND

0 gpm	Water Handling - Mine Operation Year 10
(3 gpm)	Water Handling - Mine Operation Year 23

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-16
Schematic Diagram of Water Handling (Mine Operation Years 10 and 23)
Rock Creek Project

TABLE 2-3
Water Balance Summary - Average Yearly Project Flows - Alternative II

	Line #	1	2	3	4	5	6	7	8	9	10	11	12	13	18	23	28	29	30
Adit Balance																			
Inflow																			
Adit inflow	42	4	132	407	586	632	695	712	777	843	909	974	1040	1106	1434	1763	2091	2091	2091
Ore water	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
Outflow																			
Impoundment storage	44	0	0	0	0	61	38	131	145	144	158	172	160	171	199	216	184	0	0
To biotreatment	43	4	132	407	586	571	643	556	611	676	728	772	816	851	1069	1355	1615	1796	1796
Mill reclaim pond	45	0	0	0	0	0	13	25	21	20	11	2	13	11	7	15	74	0	0
Mine workings storage	46	0	0	0	0	0	0	0	0	3	13	29	51	74	160	176	218	296	296
Ore water	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mill Balance																			
Inflow																			
Water in ore	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
From mill reclaim pond	70	0	0	0	0	0	2042	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	0	0
Outflow																			
Water in concentrate	67	0	0	0	0	0	2	3	3	3	3	3	3	3	3	3	3	0	0
Tailings	68	0	0	0	0	0	2059	3128	3128	3128	3128	3128	3128	3128	3128	3128	3128	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thickener Balance																			
Inflow																			
Tailings	92	0	0	0	0	0	2059	3128	3128	3128	3128	3128	3128	3128	3128	3128	3128	0	0
Waste water	93	0	0	0	0	0	12	15	15	15	15	15	15	15	15	15	15	15	15
Plant runoff	94	0	0	0	0	0	37	47	47	47	47	47	47	47	47	47	47	47	47
Outflow																			
Tailings slurry	95	0	0	0	0	0	539	819	819	819	819	819	819	819	819	819	819	0	0
Thickener reclaim	97	0	0	0	0	0	1570	2372	2372	2372	2372	2372	2372	2372	2372	2372	2372	0	0
Overflow to impoundment	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	62
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mill Reclaim Pond Balance																			
Inflow																			
Adit inflow	105	0	0	0	0	0	13	25	21	20	11	2	13	11	7	15	74	0	0
Thickener reclaim	97	0	0	0	0	0	1570	2372	2372	2372	2372	2372	2372	2372	2372	2372	2372	0	0
Tailings reclaim	104	0	0	0	0	0	458	705	708	709	719	728	716	719	723	714	655	0	0
Outflow																			
To mill	102	0	0	0	0	0	2042	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2-3
Water Balance Summary - Average Yearly Project Flows - Alternative II (Cont'd)

	Line #	1	2	3	4	5	6	7	8	9	10	11	12	13	18	23	28	29	30
Impoundment Balance																			
Inflow																			
Post-production thickener overflow	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	62
Excess evaporation	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	160	160
From mine for storage	111	0	0	0	0	51	38	131	145	144	158	172	160	171	199	216	184	0	0
Tailings slurry	110	0	0	0	0	0	539	819	819	819	819	819	819	819	819	819	819	0	0
Climate inflow	109	0	0	0	0	44	103	136	169	202	235	236	237	237	237	209	186	186	186
Outflow																			
Change in storage	118-108	0	0	0	0	59	-52	-1	1	1	3	3	-2	2	6	3	1	-24	0
Evap and dust sup	112	0	0	0	0	123	138	174	215	245	281	287	293	298	317	318	329	329	329
Tailings reclaim	113	0	0	0	0	0	458	705	708	709	719	728	716	719	723	714	655	0	0
Water retained in tails	114	0	0	0	0	0	223	339	339	339	339	339	339	339	339	339	339	0	0
Net seepage *	115	0	0	0	0	-77	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131
Excess to passive biotreatment	134	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	234	209
System	**SUM**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mine Workings																			
Inflow																			
Inflow to storage	122	0	0	0	0	0	0	0	0	3	13	29	51	74	160	176	218	296	296
Outflow from storage	124	0	0	0	0	0	0	0	0	3	13	29	51	74	74	192	263	111	293
Outflow																			
Change in Storage	126-128	0	0	0	0	0	0	0	-0	0	0	0	0	0	87	-16	-45	184	3
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment System																			
Treatment inflow		4	132	407	586	571	687	555	611	680	740	802	867	925	1144	1547	1878	2141	2298

Note: All values are in gallons per minute (gpm).
Line # = Line number from water balance model, see Water Management Plan (ASARCO Incorporated 1995a).
* = A worst case seepage rate of 241 gpm was used for hydrogeologic analyses.

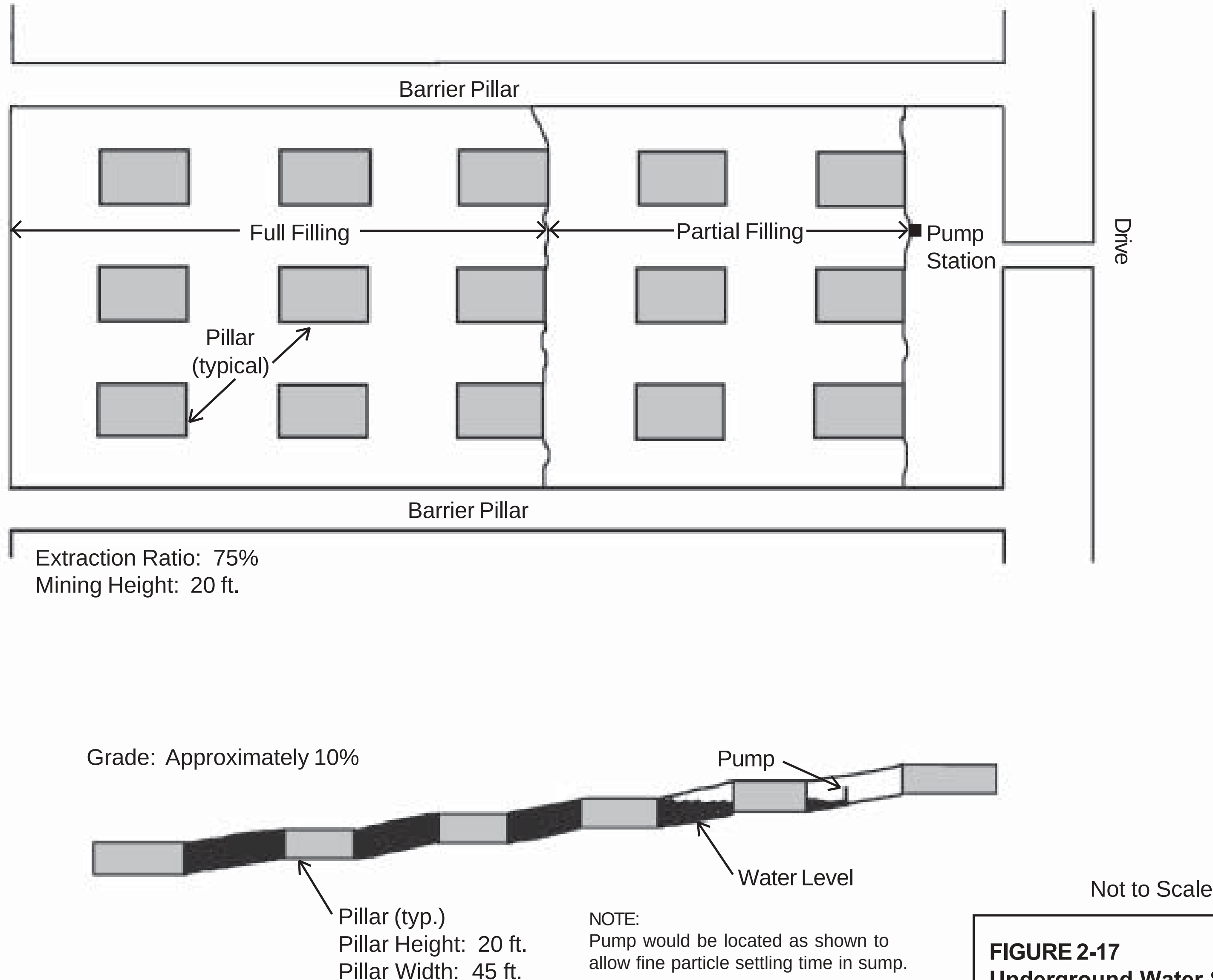


FIGURE 2-17
Underground Water Storage Schematics
Rock Creek Project

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

Sterling proposes to use a passive biological treatment system (passive biotreatment system) as the primary means to remove nitrate produced by the proposed Rock Creek project (ASARCO Incorporated 1995a). Under this system, water would be pretreated using filtration and settling to remove suspended solids, followed by mechanical aeration to decrease the ammonia fraction of the total nitrogen. Nitrate and some ammonia would then be removed in anaerobic passive biotreatment cells consisting of mill tailings, sawdust, manure, and alfalfa. The treatment plant would occupy a 10-acre site located northeast of the proposed tailings impoundment (see Figures 2-4 and 2-13). The proposed passive biotreatment system would remove 80 percent of the nutrient load (see Chapter 4, Hydrology).

Engineering specifications for the proposed Rock Creek passive biotreatment system have not been prepared as part of the revised Water Management Plan. However, data were presented from a system at a similar treatment facility. At the other facility, a passive biotreatment pilot cell is in operation. This cell consists of a clay-lined, compacted excavation with bottom dimensions of 40 by 30 feet, 2:1 side slopes, and a depth of 4.5 feet. The full-scale treatment facility is substantially larger, approximately 200 feet by 300 feet, and would treat approximately 1,500 gpm. The bottom 3 inches of the cell consist of a gravel/pipe effluent collection layer covered by a geotextile filter fabric. About 4 feet of substrate covers the geotextile, and an influent distribution pipe network is buried about a foot below the surface of the substrate. Water is fed to the cell from the top and allowed to gravity feed to the bottom of the substrate bed.

A pilot system would be constructed for treating adit discharge during exploration. This system would use a passive biotreatment cell with an ion exchange backup. If the passive biotreatment system worked as planned, it would be expanded for use during operation. If it could not adequately treat the volume of water or meet discharge standards, the ion exchange system would be expanded.

Sterling proposes to build cells that could treat 400 to 500 gpm each. The water balance indicates that about year 30, this system would need to grow to treat an average of 2,005 gpm. Sterling has agreed to provide a backup ion exchange system to its semi-passive bioreactor to ensure that year-round permit compliance can be achieved. The applicant has estimated that the potential cell life is at least 50 years. Spent substrate from the cells would be disposed in the tailings impoundment, unless the metals content was extremely high. In this case the substrate would be sent to a smelter to reclaim the metals. When treatment was complete, the passive biotreatment cells would be capped and abandoned in place.

The ion treatment system would be incorporated as a final step in the treatment process, and as a backup system if the passive biotreatment system failed or was temporarily out of service. Ion-exchange technology would remove over 90 percent of the nitrate and some dissolved ions and metals. Sterling would submit engineering specifications for the proposed ion exchange system for review and approval prior to construction. Preliminary conceptual information was presented in the revised Water Management Plan (ASARCO Incorporated 1995a). For a 650 gpm facility, 10-foot-diameter by 15-foot-tall vessels connected in series, a pump and pressure tank system to provide pressure to the exchange vessels, brine storage and supply equipment, waste brine collection equipment, and process controls and instrumentation would be required. The system for the proposed project likely would be housed in a 40-foot-by-60-foot prefabricated building, and would produce an estimated 5,800 gallons per day of waste brine. Waste brine would be disposed at a publicly owned treatment works, land-applied as fertilizer, or shipped to a manufacturer for use as an agricultural fertilizer product.

After excess water from the proposed project was treated by settling, filtration, and a passive biotreatment system, treated discharge would be piped to the Clark Fork River with a proposed outfall and engineered in-stream diffuser downstream from Noxon Reservoir. The purpose of the diffuser would be to distribute treated water though a perforated steel pipe to allow more mixing with river water. The in-stream diffuser also would reduce discharge velocities.[4]

Prior to installation, a design study would be performed to evaluate streamflow conditions and streambed characteristics at the selected outfall location. The diffuser design would be finalized after the study was complete, and an appropriate method of anchoring would be selected.

Potable water for the mill and mine and mine facilities would be obtained from a fresh water well located at the north end of the mill site (see Figure 2-10). It is estimated that this well would produce 30 gpm.

A sewage treatment facility would be incorporated into the mill complex design. This package facility would contain the standard aeration tank with activated sludge, a settling tank with a sludge return to the aeration tank, and a chlorine contact chamber. Effluent from the contact chamber would be directed to the tailings disposal system, and sludge would be disposed of at an approved off-site facility.

Transportation

During construction of the evaluation adit, access to the evaluation adit site would be via existing FDR No. 150 and Chicago Peak Road, FDR No. 2741, and a short spur road. Improvements to existing FDR No. 2741 would include a minimum road width of 14 feet, improved or added road turnouts about every 1,000 to 1,500 feet, and a reconditioning of the road surface for year-round use and maintenance. Minor amounts of clearing may be necessary for turnouts and for snowplowing. The short spur road would need a 14-foot wide surface to accommodate equipment. This work would be done in consultation with the Forest Service. Employees would use the parking lot at Sterling's support facility and would be transported in four-wheel-drive vans to the adit. This would limit mine-related traffic to the minimum number of vehicles needed to transport work crews and supplies to the adit.

Because of the year-long schedule for adit construction, it would be necessary to plow snow on FDR No. 2741 for one winter. Snowplowing for FDR No. 150 would occur over mine life. Snow removal and disposal would follow Forest Service guidelines.

Traffic to the mine site would include employee commuting, weekday delivery of supplies, and hauling of concentrate by truck to the Hereford loadout. To access the proposed mill site, vehicles would use FDR No. 150 for about 6.5 miles. Starting at Montana Highway 200, Sterling proposes to relocate about 1.34 miles of FDR No. 150 to bypass the tailings impoundment. Both the relocated and existing roads to the mill site would be upgraded to a 24-foot paved surface to handle the projected traffic load (see Figure 2-18). A new bridge over Rock Creek would be required at the junction of the new and existing road. The two existing bridges on FDR No. 150 over Rock Creek would be replaced.

[4] The diffuser would be fixed at the bank on concrete thrust blocks and surrounded by cobble riprap to provide shoreline protection. It would lie in the river channel, perpendicular to the flow of the river. The perforations of the diffuser system would be designed to reduce the discharge velocity to less than 2 feet per second, and allow mixing to occur across a broad cross-sectional profile of the river.

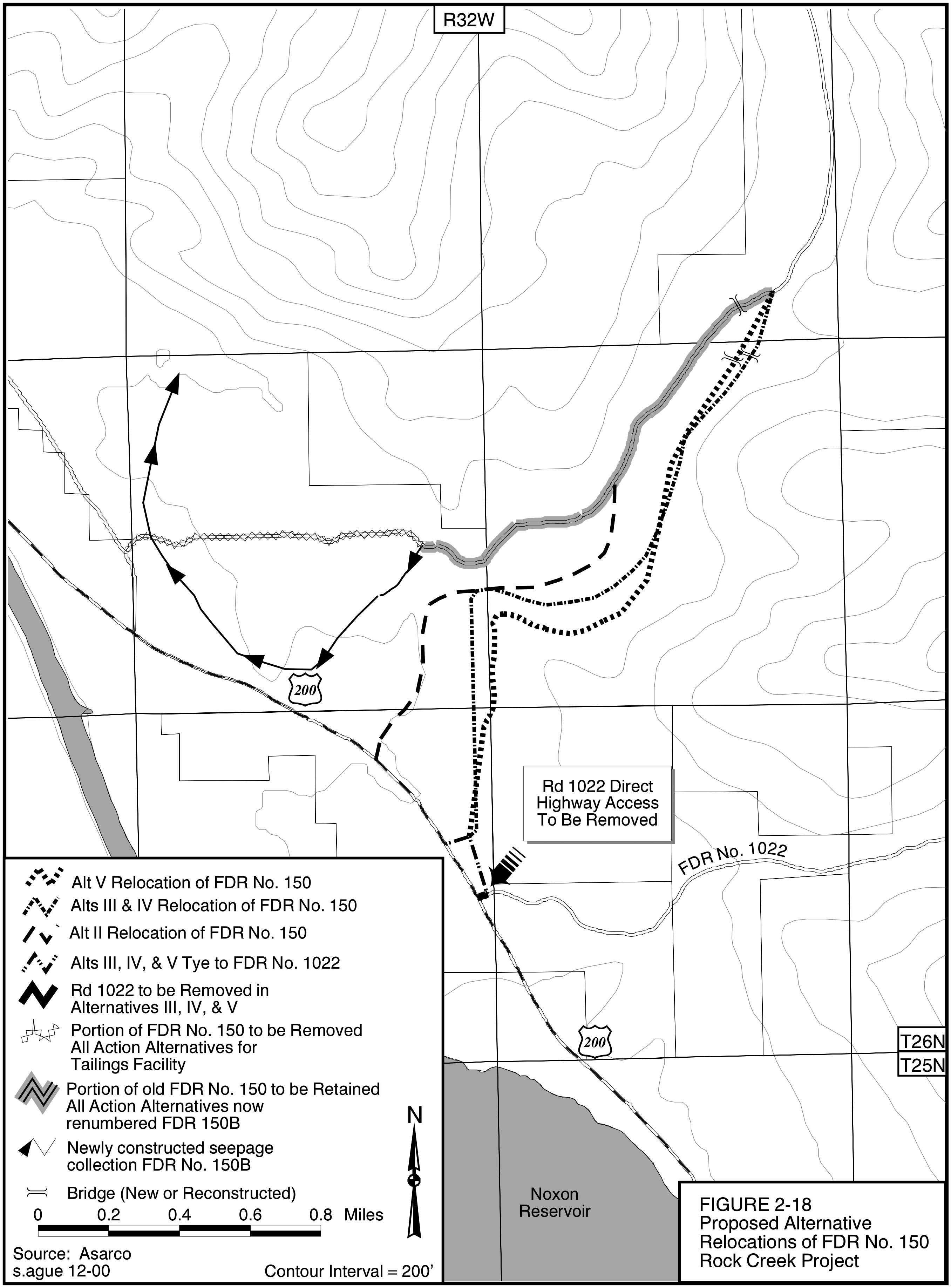


FIGURE 2-18
Proposed Alternative Relocations of FDR No. 150
Rock Creek Project

FDR No. 150 and associated bridge construction and reconstruction below the proposed mill site would be done during the last half of the year of evaluation adit construction (see Figure 2-4). For public safety and mill complex security, Sterling also proposes a relocation of about 1.12 miles of FDR No. 150 around the proposed mill site (see Figure 2-10). Beyond the mill's main entrance, the relocated single-lane graveled road would be built to Forest Service standards.

An extension to the culvert on the WFRC above the last bridge on FDR No. 150 is proposed.

Sterling proposes to construct an 1.67 miles mine access road from the mill site to the mine portal (see Figure 2-19). This road would have a 14-foot-wide gravel surface.

Additional gravel roads or maintenance trails would be required to provide access to the utility corridor where it does not follow FDR No. 150 (10 to 14-foot-wide road for pipeline maintenance, repair, and monitoring), the reclaim pump station and tailings impoundment (FDR No. 150B and seepage collection system road), and the surface conveyor (see Figure 2-4). Sterling would be responsible for maintaining these mining-related roads and trails. Maintenance of FDR No. 150 would be Sterling's responsibility, unless additional use by the Forest Service or other interests warranted a cost-share agreement. Upon completion of mining activities, those roads needed for public use would be maintained by the county or Forest Service. Road closure is discussed in the Threatened and Endangered Species section of Chapter 4.

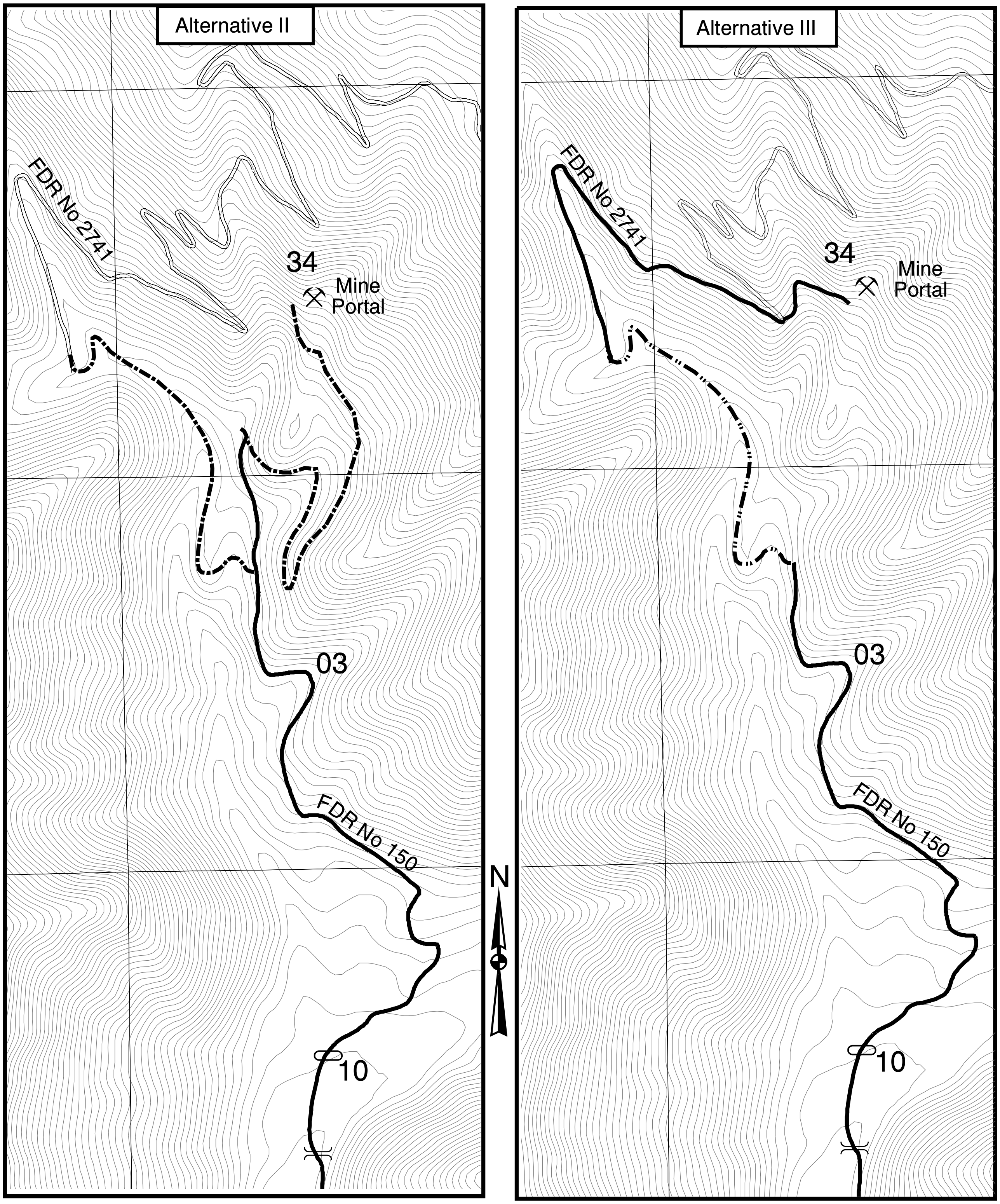
Utilities

There would be no electric lines to the evaluation adit site. During the year of evaluation adit construction, two 500-kW diesel generators would provide power for the drills, pumps, vent fans, and shop. Electric power for support facilities would be supplied from an existing local distribution line.

A 230 kilovolt (kV) electrical service to the mill site would be provided via a new, overhead transmission line (5.7 miles). Sterling proposes to use 61-foot-high wooden utility poles within a cleared 100-foot right-of-way. One switchyard may be constructed adjacent to the Noxon/Libby 230 kV line near Highway 200 in a dedicated powerline right-of-way. Two new substations would be constructed:

- one would be constructed at the mill site to distribute electricity through lower voltage lines to equipment within the mill site, adit, and mine; and
- a second would be constructed near FDR No. 150 in the vicinity of the impoundment for electrical distribution to that area. This would involve clearing a 100 by 100 foot area and fencing it.

All transmission distribution lines (4.16 kV and smaller) would be buried in conformance with KNF policy. The transmission line and all substations would be removed during mine reclamation.



Proposed New Road Construction
Proposed Road Reconstruction
Replacement Bridge
Extended Culvert

0 0.2 0.4 0.6 Miles

Contour Interval 80'

Source: Asarco
s.ague 12-00

FIGURE 2-19
Alternative Mine Access Roads
Rock Creek Project

The applicant would be responsible for paying all construction costs for the substations and transmission line. Annual power consumption is estimated at 95,000,000 kW-hours, with a peak demand of 13,300 kW. No power provider has been selected. The two tailing slurry pipelines would be located above ground but the water reclaim pipelines and the water discharges to the wastewater treatment plant would be buried.

Erosion and Sediment Control

Wind and water erosion control measures are described in detail throughout Sterling's permit application in operation and reclamation plans. These measures involve 1) mechanical practices to minimize fugitive dust, 2) grading to reduce erosion potential, 3) soil-handling techniques to enhance stability, 4) hydrologic systems to control runoff and sedimentation, and 5) revegetation practices to provide a stabilizing cover. (Soil handling and revegetation measures are discussed in more detail under Reclamation.) Sterling would follow Forest Service soil and water conservation practices. A storm water discharge permit would be required from DEQ. As part of this permit, Sterling would be required to submit a storm water management plan for DEQ approval. This plan would describe the methods to minimize and control runoff contamination.

Fugitive Dust Control. During the construction and operational phases of the project, the following procedures would be used to control emissions affecting air quality.

- The main access road (FDR No. 150) to the mill facilities would be paved (see Figure 2-4).
- All unpaved roads would be watered or a dust palliative used as needed to reduce fugitive dust.
- Waste rock, soil, and other dust-forming debris would be promptly removed from roads.
- Vehicle speeds would be restricted on haul roads to reduce the amount of fugitive dust.
- Revegetation, mulching, and stabilization of road cut-and-fill areas would occur in the first appropriate season after construction.
- Revegetation of other disturbed soils would occur in the first appropriate season after disturbance.
- Vehicular traffic would be restricted to established roads.
- The area of land disturbance would be minimized.
- Dust generated at loading and transfer points would be restricted with dust collection systems.
- Emissions from ore processing would be restricted with water sprays or dust collection systems.

- Heavily used haul and access roads would be chemically stabilized with nontoxic soil cement or dust palliatives mixed into the upper 1 to 2 inches of road surfaces as necessary.

- A covered conveyor system would be used to minimize emissions.

- Blowing tailings would be controlled using a sprinkler system.

- Proper maintenance would be performed to minimize gaseous emissions from internal combustion engines.

Site Grading. Erosion potential would be minimized by the following measures.

- Rills and gullies would be stabilized and revegetated.

- Slopes would be visually inspected periodically throughout the operation to detect early signs of impending slope failure.

- Road grades would be designed to disrupt natural drainage patterns as little as possible.

- Surface drainage from unpaved roads would be routed to ensure that sediment is filtered or settled out prior to delivery to streams.

- The overall slope of the tailings dam face would be 3:1.

- Erosion bars or drive-through dips would be constructed on unpaved roads.

- Disposal methods for tailings would prevent runoff over the dam face.

- Equipment would work along contours where possible to minimize creation of channels. When work on slopes must be perpendicular to contours, crawler tracking or dragging would be used to reduce channeling effects of grading.

Soil-handling Techniques. The following activities would be conducted to reduce potential erosion.

- Soil salvage would occur incrementally (when feasible) with disturbances to minimize the area exposed at any given time. This would reduce the length of time soil remained stockpiled and reduce wind and water erosion associated with soil salvage.

- Soil stockpiles would be located and designed to minimize wind and water erosion. Stockpiles would be located away from drainages on the gentlest slopes available. Stockpiles would be designed with 2.5:1 sideslopes and would be revegetated for stabilization.

- Sterling would direct-haul (taking directly from the excavated site to a reclamation site) soil whenever feasible.

Hydrologic Measures. The following steps would be taken to control runoff and sedimentation. For more information, see the applicant's storm water plan and revised water management plan (ASARCO Incorporated 1995a).

- A drainage and diversion system would be constructed at all disturbance sites to control runoff and sedimentation during the operation period. This system would include diversion of off-site runoff waters and containment of runoff and sediment from disturbed areas.

- Windrows of woody debris or logs would be placed parallel to slope contours below long fill slopes.

- Rights-of-way clearing would be minimized to reduce the total area susceptible to erosion.

- Naturally occurring runoff from hillsides above the mill site would be diverted around the site (see Figure 2-10).

- Two intermittent streams would be routed through the mill site in engineered channels stabilized to ensure that erosion of the channel beds and banks does not occur.

- Collection and routing of all water originating within the mill site would be routed to a drainage sump for use as process water.

- A sediment containment system downstream of disturbed areas would prevent sedimentation in natural drainages in the area.

- A diversion system would be constructed at the toe of the proposed waste dump. This ditch would intercept any runoff from the waste dump and divert it through a series of sediment control ponds prior to returning the water to the natural drainage.

- During the life of the operation, seepage collection ditches would intercept sedimentation originating from dam faces.

- Naturally occurring runoff from undisturbed hillsides above the evaluation adit site would be diverted around the site in a structure sized to convey a 24-hour, 25-year storm event (see Figure 2-6).

- Collection and routing of all water originating within the evaluation adit site would be routed to the lined pond and then pumped to the adit sump for precipitation of suspended solids and skimming of oils. Excess surface drainage would be discharged from the pond through an overflow structure into the pipeline to the passive biotreatment system prior to draining to the Clark Fork River.

Revegetation Practices. The following practices would be used during the operational phase to provide a permanent, stabilizing plant cover.

- Rapidly developing and sod-forming plant species would be included in the seed mixture to provide rapid stabilization.
- Revegetation would occur in the first appropriate season after soil redistribution.
- Mulch (or tackifiers on hydromulched areas) would be applied to aid in erosion control and moisture retention.
- Revegetated areas would be protected from disturbance by banning traffic until vegetation became established.
- Interim revegetation would be used to stabilize disturbed areas.
- Trees would be planted in years 34-35 (end of mine life) on the tailings impoundment face and surface for stabilization, wildlife edge, seed source, and screening.
- Shrubs would be planted on road cut-and-fill slopes if necessary to reduce erosion.
- Seedbed preparation and seeding activities would be conducted on the contour on all slopes. Slopes less than 33 percent would be drill seeded. Rocky areas and slopes exceeding 33 percent would be broadcast-seeded.

Precipitation would retard blowing tailings during winter and spring. Sterling would use sprinkler irrigation to abate dust during dry periods. Since the impoundment surface would be continually rising, interim tailings stabilization by sprinkling would be ongoing. Long-term tailings stabilization and reclamation would be provided by capping the impoundment surface with soil and revegetating. More specific requirements would be contained in the air quality permit for the project.

Employment

Development of the evaluation adit would take about a year. Work would start with 39 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction might immediately follow the adit work, or there could be a period of inactivity lasting months or even years between the two activities.

Mine construction and production startup would take about three-and-a-half years. Contract construction would occur during the first eighteen months of this phase. It would employ 235 workers initially, increasing to 345 during the fifth quarter. During this same period Sterling employment would start at 34 employees and eventually reach 355 job as the mine approached full production. The combined total of contract and company employees would peak at 433 jobs during the fifth quarter before dropping to 92 employees in the seventh quarter. Sterling would have no direct control over contract labor schedules. It is expected that the contractor would use a 7-day work week with more than one shift per day.

Permanent operating employment is projected to stabilize at 355. The project would operate 24 hours per day, 7 days a week, 354 days a year. It would have an expected operating life of up to 30 years. At the end of production there would be a two-year shutdown and reclamation period employing 35 workers. Because the available labor force initially would not have all the skills needed to develop and operate the mine, the applicant proposes to conduct an intensive training program.

Adit Closure

The evaluation adit would be sealed to prevent human access after mine operations ceased (ASARCO Incorporated 1992). The mine permit application is not specific as to whether or not mine adits would be sealed or left free draining; but probably the mine adits as well as the evaluation adit would be plugged by concrete bulkheads leaving near vertical faces.

The wilderness air intake ventilation adit would be reclaimed. The grate and fan would be removed and the adit would be sealed with a 12-inch-thick bulkhead. The bulkhead would be constructed from within the adit using reinforced concrete. Equipment removal and plugging would be conducted from inside the adit.

Reclamation

Short-term reclamation objectives are to stabilize disturbed areas and to prevent air and water pollution. The long-term reclamation objective is to establish a postoperational environment compatible with existing land uses and consistent with the Forest Plan. Specific reclamation objectives include the following:

- permanent protection for air, surface water, and ground water resources;
- protection of public health and safety by removing potential hazards;
- maintenance of public access through the project area;
- restoration of wildlife habitat;
- design of a land configuration compatible with the watershed;
- re-establishment of an aesthetic environment allowing for visual quality and recreational opportunity; and
- re-establishment of postoperation biological potential suitable for supporting vegetative cover appropriate to the area.

To accomplish these objectives, the applicant proposes to provide interim and postmine stabilization of most disturbed areas, to follow measures described under Sediment and Erosion Control, and, after mining, to reclaim all disturbed areas by recontouring and redistributing soil, and revegetating.

Postmining Topography. All buildings and other structures at the evaluation adit support facilities site would be removed once the mill site was operational. It is estimated that the support facilities would be used through exploration and the first 3 to 4 years of mine construction and operation. This site would be recontoured to approximate original contours.

The tailings impoundment would be reclaimed to the configuration shown on Figure 2-20. The 3:1 side slopes, having undergone concurrent reclamation (see Revegetation) during construction, would remain as constructed during the operational phase of the project. The final perimeter dikes, beach, and pond area located on top of the tailings impoundment would be graded as shown on Figure 2-20 once the pond area had dried sufficiently to allow equipment access.

The diversion structures above the reclaimed tailings impoundment would remain as permanent stream channels to route runoff around the reclaimed tailings mass. All mechanical facilities associated with the tailings impoundment would be removed. The remaining surface disturbances (e.g., runoff control ditches along the embankment toe, seepage capture and return ponds, and facility pads, water reclaim facility sites, soil stockpile sites, emergency dump ponds, and internal and perimeter access roads) would be returned to approximate original contour.

After mining and ore processing were completed, all buildings and related equipment and infrastructure, the conveyor, powerline, and surface tailings lines would be dismantled and removed. The reclaimed configuration of the mill site would result in an expanded bench sloping southeast. The area would be graded to the final topography shown in Figure 2-21. Internal roads and parking areas would be graded to approximate original contours. Paving material would be buried on site or removed to a disposal facility. Inert waste such as steel, concrete, plastic, or wood would be buried in on-site waste disposal areas or sold to scrap dealers for recycling; some waste may be transported to an approved waste transfer station as authorized by the county solid waste district. It is assumed that buried pipelines would remain in place.

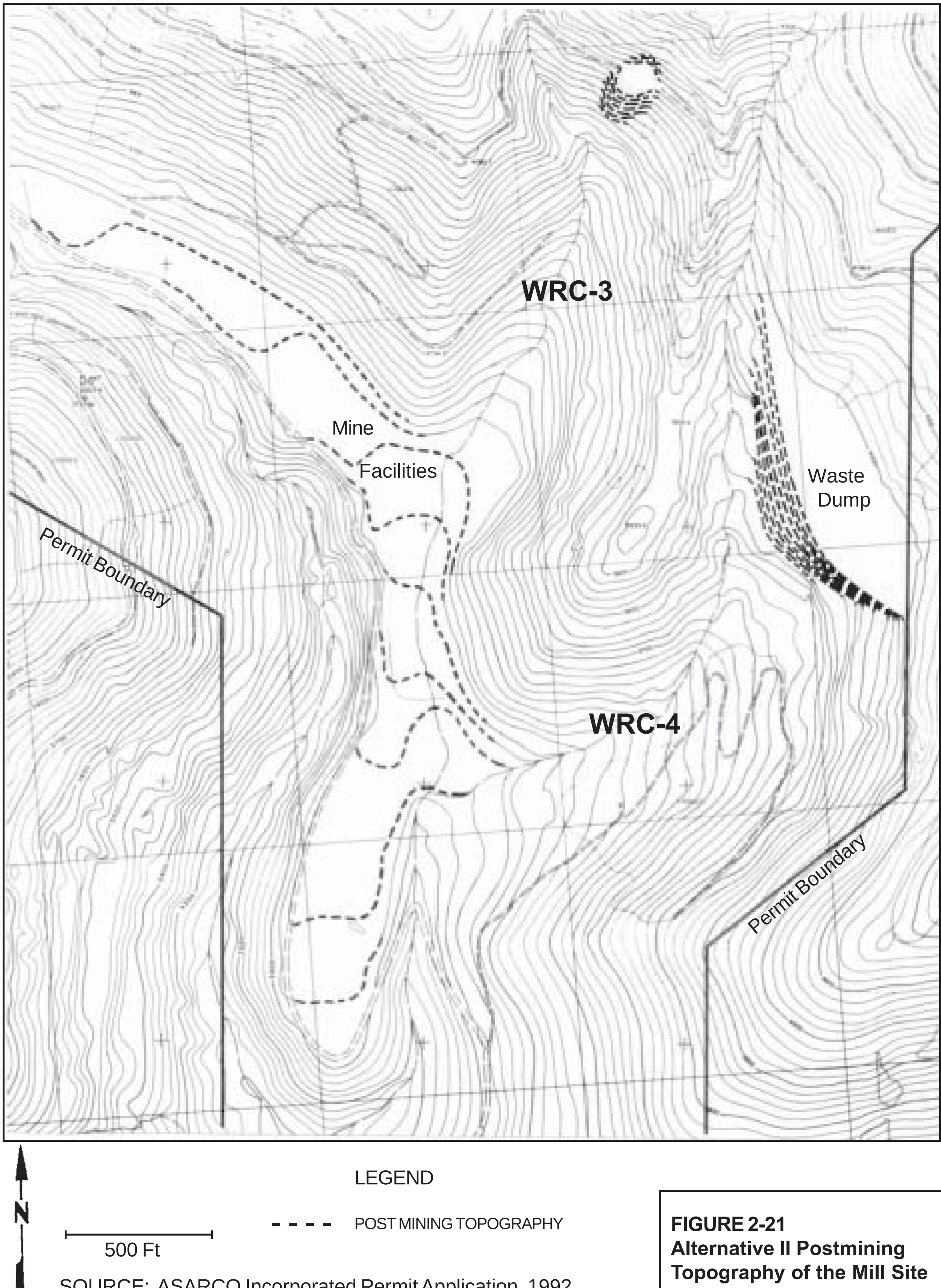
Once ground water quality beneath the impoundment met water quality standards, and Sterling was given permission to shut down the ground water pump-back system, all remaining impoundment-related surface components would be removed, wells decommissioned, and the sites regraded according to approved plans. When the water treatment facility would not be needed for treating mine adit discharge, the buildings, related equipment and surface discharge pipelines would be removed and the sites regraded to approximate original contour.

The waste rock dumps for the mine and evaluation adits would become generally flat-topped benches sloping southeast, about 1 and 2 percent, respectively. The face of the evaluation adit waste rock dump would have a 2:1 slope while the mine waste rock dump would have a 1.25:1 slope. The 1-acre benches in front of the evaluation and mine adit portals would be sloped to drain at about 1.0 percent to the southwest.

A channel would be constructed across the evaluation adit waste rock dump from the area of the backfilled lined pond to the access road cut to connect natural drainage areas above and below the evaluation adit dump. This channel would be lined with coarse rock to prevent erosion. Disturbances other than the evaluation adit waste rock dump (i.e., facilities area, diversion ditches, fuel storage area) would be graded to blend with adjacent undisturbed topography.

Source: ASARCO, Incorporated 1987-1994.

FIGURE 2-20
Alternative II Postmining Topography of the Tailings Impoundment
Rock Creek Project



LEGEND

POST MINING TOPOGRAPHY

SOURCE: ASARCO Incorporated Permit Application, 1992

FIGURE 2-21
Alternative II Postmining Topography of the Mill Site Rock Creek Project

The borrow areas would be reclaimed to approximate original contours with slight steepening at the upper contact with natural grade and flattening at the lower contact. Transition areas from natural to reclaimed areas would be smoothed, rounded, and graded to drain substantially the same as the original configuration. Wetland reclamation is discussed in the Monitoring and Mitigation Plan section under the Wetland Mitigation Plan.

New access roads designated for public use would remain in place. Mine access road and other project-related roads would be reclaimed if not needed for long-term monitoring and water treatment.

Soil Salvage and Handling Plan. Soils salvaged from 7.7 acres at the evaluation adit site would be removed in two lifts where soil was available and where slopes were less than 2:1. The soil would be stockpiled northwest of the evaluation adit (see Figure 2-6). All of the first lift soil and half of the second lift soil would be redistributed over 5.0 acres at the adit, waste rock dump top, and facilities to an average total depth of 12 inches. The remaining second lift soils would be redistributed over a portion of the slope face of the dump designated for revegetation at an average depth of 13 inches over 1.9 acres. Approximately 1.4 acres on the waste rock dump would be left as talus to achieve a mosaic appearance.

Soils would be salvaged from the 1.3 acres at the proposed parking lot and garage/warehouse at the proposed exploration support facilities site and stockpiled just west of the parking lot. Soils would be replaced once the buildings and other features had been removed and the site regraded at a depth of 24 inches (Young 1994).

Soils would be salvaged in a single lift from disturbed areas at the mill site and impoundment where slopes were less than 2:1 and where coarse fragment (rocks greater than 2 millimeters) content was less than 50 percent, with the exception of soil stockpile sites and other miscellaneous areas. (See Tables 2-4 and 2-5). Slopes over 50 percent are considered unsafe for conventional salvaging techniques. Soils containing coarse fragments in excess of 50 percent by volume are considered unsuitable for salvage. The suitability of soils proposed for reclamation was determined from physical and chemical data collected during the baseline soil survey (ASARCO Incorporated 1987-1997).

Soil would be direct-hauled or stored in stockpiles as close to eventual redistribution sites as possible (see Figures 2-4, 2-6, 2-10, and 2-13). Direct-hauling would occur primarily at the tailings impoundment. Measures would be taken to minimize compaction and handling. Reclaimed soil depths would average about 9.5 inches on the tailings pond and associated disturbances, 11.4 inches on the facilities site, waste rock dump top, and mine area, and 14.3 inches along the transportation corridor. Soils would be replaced to a depth of 24 inches at the wastewater treatment plant site.

Prior to redistribution, compacted areas (especially the waste rock dump top, roads, soil stockpile sites, and facilities area) would be ripped with heavy equipment to relieve compaction. This would eliminate potential slippage at layer contacts and promote root penetration. Soil salvage and redistribution would occur throughout the life of the operation.

Soil stockpiles would be constructed with a 2.5:1 side slope and 3:1 ramps. As stockpiles reached their design capacity, they would be stabilized and seeded. Seeding would be conducted during the first appropriate season following stockpiling. Fertilizer and mulch would be applied to the piles as necessary.

TABLE 2-4
Soils Salvage Summary - Alternative II

Disturbance	Soil salvage area (acres)[1]	Salvageable topsoil (yd^3)[2]	Stockpile number
Evaluation Adit			
-Portal area\first lift -	7.7	2,369	evaluation adit site
-Portal area\second lift	2.0	6,388	evaluation adit site
-Subtotal for portal area	7.7	8,757	
-Support facilities	1.3	4,195	adjacent to parking lot
Tailings impoundment & associated components			
- Dam faces & impoundment surface	324	378,770	1, 2
- Borrow areas 2 & 3	27.2	48,642	2
- Roads (access, haul)	5.4	9,290	adjacent to road
- Water control structures	9.2	17,141	adjacent to structure
- Pump station	0.2	323	2
Transportation corridor			
- Access road	16.9	32,024	adjacent to road
- Tailings line corridor	10.2	19,560	adjacent to corridor
- Emergency impoundments	2.0	4,302	adjacent to impoundment
- Fresh water well	0.2	485	adjacent to well
Water treatment facility	10.0	32,269[3]	2
Mill facilities			
- Fenced area	40.0	91,840	3, 4
- New public road	2.8	7,341	4
- Fresh water well	0.1	81	adjacent to well
- Water control	1.5	929	adjacent to structure
Mine			
- Access road	0	0	
- Waste rock dump[4]	10.0	0	5
- Portal area	0	0	
- Water control structures	0	0	
Total	**468.7**	**664,706**	

Source: ASARCO Incorporated 1987-1997.

Note: [1]Total soil salvage acreage does not equal total disturbance acreage in Table 2-2 because soil would not be salvaged from the mine, soil stockpile sites, powerline and conveyor corridors on slopes that exceeded 2:1, or areas where soil has already been removed (such as existing roads). Soil stockpiles are shown on Figures 2-4, 2-6, 2-10 and 2-13.

[2]Volumes represent in-place measurements; yd^3 = cubic yards.

[3]Volumes estimated by the Agencies.

[4] Slope is close to 50% (1:1) below waste rock dump footprint. If operator safety allows, soil would be salvaged. No volume has been calculated but soil would be used to partially cover the upper face of 1.25:1 waste rock dump slope.

TABLE 2-5
Alternative II Soil Replacement Depths

Mine Facility	Replaced Soil Depth (inches)
Evaluation adit:	
Portal and waste rock dump top	12
Waste rock dump face, 1.9 acres - revegetated	13
Waste rock dump face, 1.4 acres - talus	0
Support facilities site	at least 12 inches
Mill site, waste rock dump top, and mine portal	11.4
Waste rock dump slope	some on upper face
Transportation corridor	14.3
Tailings impoundment and associated facilities	9.5
Water treatment plant	24.0

Revegetation. The applicant proposes to meet short- and long-term objectives stated in its revegetation plan. The plan specifically addresses species selection for final and interim seed mixtures and planting schemes, seeding and planting rates, seedbed preparation, seeding and planting methods, cultural treatments, and interim revegetation. The proposed seeding and planting mixes are presented in Appendix J and the applicant's Reclamation Plans (ASARCO Incorporated 1987-1997).

The proposed species selection and seeding/planting rates are based on preoperation vegetation types, environmental tolerance, species that exhibit hardiness on postoperation sites, and a variety of other factors. An understory seed mix consisting of grasses and forbs would be used on all disturbance areas. Shrubs would be seeded on most sites, but not on the evaluation adit site or the transportation and utility corridors.

Grass species proposed, including both native and non-natives, are typical of those used for reclaiming sites in similar settings. Forbs and shrubs proposed are native species that typically occur in one or more of the communities identified within the project area. Alsike clover, a non-native forb, is proposed to ensure that important nitrogen-fixing processes occur. An annual cereal grain would also be added to the mix to ensure rapid cover. Seed mixtures may be modified due to limited species availability, poor initial performance, advances in reclamation technology, or a variety of other factors.

Seeding rates would average about 120 pure live seeds per square foot (13 to 16 pounds per acre) for drill seeding and roughly twice that for broadcast seeding. Drill seeding would occur on slopes of less than 3:1 (horizontal to vertical) that are not rocky as determined by the Agencies. Steeper slopes and rocky areas would be broadcast or hydroseeded (a technique where seed is mixed into a slurry and sprayed onto a slope). Seeding would occur in the first appropriate season following site preparation.

The applicant proposes a number of cultural treatments for seedbed preparation. Sites would be prepared for seeding by grading; ripping to prepare the surface for soil placement; respreading salvaged soil; and tilling soils on gentle slopes (3:1 or less) to break up clods and relieve compaction, as needed. Phosphorus fertilizer, important for seedling establishment, would be applied prior to seeding. Once seeding occurred, straw mulch would be applied and anchored according to slope steepness and seeding method. Nitrogen fertilizer would be applied early in the subsequent growing season to enhance growth.

Trees would be planted on slopes that do not exceed 3:1 in the tailings impoundment area, the facilities area, the waste rock dump top, and the access road to the waste rock dump. Trees would be planted in 2-to-4-foot-wide strips alternating with 8-foot-wide strips that were drill seeded. Trees would be planted 6 feet apart to achieve an initial stocking rate of 663 trees/acre. Reforestation of the transportation corridor and the evaluation adit area would rely on natural regeneration. Shrubs would be planted on the tailings impoundment face. Shrubs would be planted on the access road cuts, only if herbaceous vegetation was not providing adequate erosion control.

Interim revegetation would take place during construction and operation on many disturbed areas to reduce erosion and sedimentation until final reclamation could be implemented. These areas would include roads, soil stockpiles, the utility corridors, and other areas. The interim seed mix is the same grass mix proposed for final reclamation except that clover would not be used for interim reclamation. Areas would be broadcast seeded or hydroseeded, mulched, and fertilized.

Throughout mine life, disturbances would be seeded as they occurred with the interim seed mix. Final revegetation (seeding) would occur in some areas during the preoperational phase; others would be revegetated incrementally when possible, such as the impoundment face. Final revegetation of all other disturbances not previously reclaimed would be completed within 2 years after mining except the tailings impoundment which would be reclaimed within 2 years after drying. Trees and shrubs would be planted on the impoundment face after operations ceased so that the dam face could be inspected for stability during the operational phase. Elsewhere, trees would be planted in the first appropriate season following final revegetation.

Monitoring and Mitigation Plans

Air Quality Monitoring. Sterling would be required to monitor air quality around the operation as part of its air quality permit. The specifics of the monitoring plan would be reviewed annually. The purpose of the plan would be to evaluate the effectiveness of implemented air pollution control technologies.

Soils and Erosion Control. All reclaimed areas would be inspected for erosion in spring and fall until they became stabilized. Evidence of erosion would be repaired and reseeded. An approved monitoring schedule would be developed for the tailings impoundment during the final design phase.

Soils would be tested for fertilizer needs and macronutrient content. Tailings and waste rock would be sampled for constraints to revegetation including texture, coarse fragment content, and pH. Structural measures would be taken to prevent erosion and sedimentation.

Revegetation. Revegetated areas would be field checked during the first season following revegetation to determine success. Monitoring would include qualitative evaluation of cover, species composition, and tree planting success. If problem areas were identified, remedial action would be taken. Evaluation of site-specific reclamation would also be conducted on rights-of-way, the tailings dam face, and waste rock dump. Evaluation parameters would include species response, soil distribution depth, planting techniques, effects of fertilizer rates, and reclamation success on steep, rocky slopes.

After final reclamation, revegetated areas would be protected for 2 years where necessary from vehicle and livestock use. Control of wildlife damage would be attempted. A noxious weed control plan would be developed in accordance with the Sanders County Weed District and, where applicable, with Forest Service guidelines. No postoperational treatments (except nitrogen fertilizer) would be implemented other than normal forest practices.

Fish and Wildlife. The applicant's fish and wildlife mitigation plan was formulated to minimize and/or mitigate the effects of the mine operation. Mitigation measures proposed include the following:

- conspicuously posting all applicable state and federal hunting, fishing, trapping and recreation regulations. Meeting with appropriate regulatory agencies to discuss regulations to be posted, locations of signs, and any special regulations pertinent to adjacent lands;
- developing and enforcing wildlife policy to prohibit carrying of firearms in Sterling vehicles, hunting within Sterling property by employees and the public, unauthorized off-road vehicle use in the project area, and to discourage wildlife harassment and littering;
- minimizing vehicular disturbance by dust suppression, paving, speed limit enforcement, and encouragement of carpooling;
- cooperating with appropriate agencies regarding trespass, game violations, or other wildlife problems; and
- maintaining access to public lands adjoining the project area.

Threatened and Endangered Species. A plan was developed to mitigate effects on threatened and endangered species.[5] In addition to the measures suggested above for wildlife, Sterling would:

- construct powerlines following criteria outlined by Olendorf, Miller, and Lehman (1981) to reduce potential for electrocution of bald eagles;
- develop and implement a grizzly bear management program in conjunction with appropriate state and federal agencies; and
- not use clover in the seed mix used on any disturbed area during active operations to reduce grizzly/human encounters caused by bears being drawn to clover sites.

---

[5] Although not proposed by the applicant, the KNF has determined that 5.28 miles of roads would need to be closed to meet the Forest Service Standard of 0.75 miles of open road per square mile.

Water Monitoring Plan. The applicant's water monitoring plan includes baseline, operational, and postoperational monitoring of surface and ground water resources. The postoperational monitoring program would be modified based on operational monitoring results prior to the termination of mining activity. Plans would be subject to review and final approval by DEQ and KNF.

Rock Mechanics Monitoring. The applicant proposes to utilize experience gained from the Troy Mine, and field observations adapted to rock mechanics theories and practices for designing this mine. Data from the evaluation adit also would be incorporated.

Tailings Impoundment and Tailings Slurry Line Construction and Operation Monitoring Plan. The construction monitoring plan for the tailings impoundment and the tailings slurry line is divided into four discrete time segments. The intent of the monitoring plan is to provide the Agencies with the information necessary to judge whether the facilities are being constructed and operated within the design and performance standards set forth in the application and existing permits. The four time segment areas are:

- Final Design Phase: Agency review and approval of final designs for tailings impoundment, tailings slurry lines, and emergency dump ponds.

- Preproduction Construction Phase: Standard inspection and quality control procedures would be implemented with periodic interim construction reports submitted at 2-month intervals during construction of tailings starter dams. A final construction report would be submitted prior to operation. This report would contain as-built drawings.

- Operational Phase: Monitoring would continue throughout project life and would include routine inspections and reports of facility geometry, material specification, embankment drainage, foundation pore pressure, and observational performance.

- Interim Facility Shutdown: In the unlikely event of a shutdown, the tailings impoundment monitoring plan would be continued.

Hard Rock Mining Impact Plan. The applicant has completed a Hard-Rock Mining Impact Plan in coordination with Sanders County and other impacted jurisdictions (ASARCO Incorporated 1997b), and the plan was approved by Sanders County on October 21, 1997. This plan provides a coordinated mechanism for allocating project tax revenues to local government jurisdictions that would experience increased capital and operating costs but not receive appropriate project tax revenues. It also calls for prepayment of selected local taxes where revenues would lag behind demands on local government services. The plan was developed using Alternative IV and V employment projections and development schedules. If Alternative II or III were permitted some plan provisions might need to be modified.

Wetlands Mitigation Plan. The applicant completed the identification and delineation of wetlands and non-wetland waters of the U.S. for the study area. The inventory encompassed areas proposed to be disturbed by the tailings impoundment, mine entry and access roads, mill site, evaluation/exhaust ventilation adit, and most of the alternative areas included in this EIS. Based on the delineation, the proposed project would affect approximately 1.5 acres of waters of the U.S. and 8.1 acres of wetlands (see Table 2-6). Wetlands and non-wetland waters of the U.S. resources are described in detail in chapters 3 and 4.

TABLE 2-6
Affected Acreage of Wetlands and Non-wetland Waters of the U.S. by Mining Alternatives

Mining Alternative	Affected Acreage (Direct and Indirect)		
	Wetlands	Waters of the U.S.	Total Acres
Alternative II - Proposed Project	8.1	1.5	9.6
Alternative III - Proposed Project with modifications and mitigations	6.2	1.5	7.7
Alternative IV - Modified Rock Creek Project with mitigations	6.2	0.4	6.6
Alternative V- Tailings Paste Deposition	6.2	0.4	6.6

Source: ASARCO Incorporated 1993 and 1997c

The applicant prepared a Wetland Mitigation Plan (ASARCO Incorporated 1993) in compliance with Section 404(b)(1) of the Clean Water Act. The mitigation plan provides for the mitigation of and compensation for the unavoidable loss and potential diminishment of the wetland functions and values associated with development of the proposed project. In the mitigation plan, the applicant proposes to create 12.3 acres of wetlands on site to compensate for the loss of about 8.1 acres of wetlands (see Table 2-7). Approximately 1.5 acres of non-wetland waters of the U.S. (primarily without vegetated wetlands) would be affected by the project. The proposed mitigation would create about 1.5 acres of non-wetland waters of the U.S. on site at the end of the project.

TABLE 2-7
Proposed Acreage and Schedule for Created Wetlands and Reconstructed Non-wetland Waters of the U.S. - Alternative II

Wetland Mitigation Sites	Created Acreage		Schedule
	Wetland	Non-wetland Waters of the U.S.	Project Year
Mill site area		1.5	30
Borrow area 3	7.5		4 - 5
Access road sites	1.8		1
Miller Gulch sites	1.2		1 - 2
Rock Creek sites	1.8		1
TOTAL WETLAND MITIGATION	**12.3**	**1.5**	1 - 30

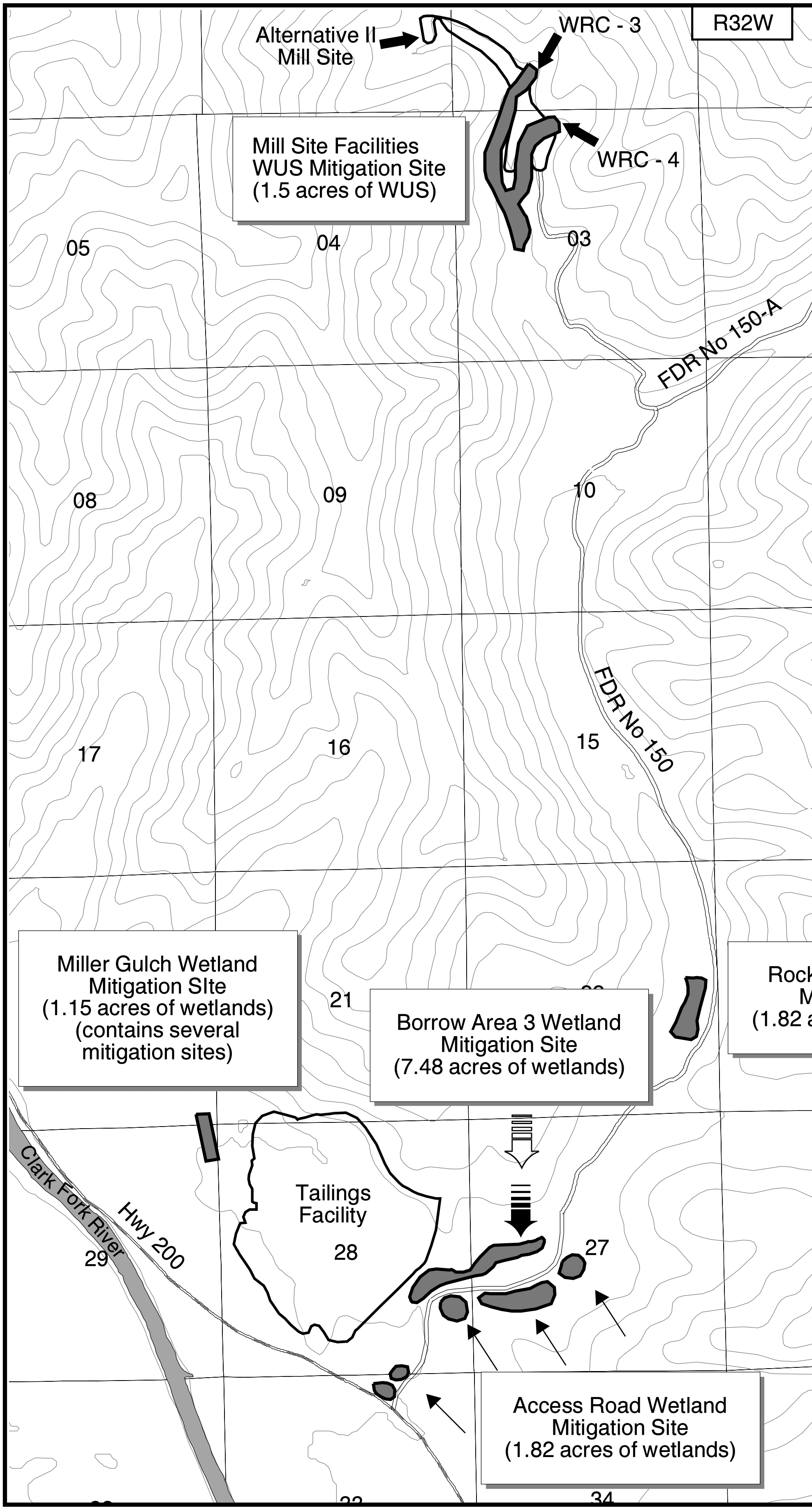
The applicant identified four possible wetland mitigation areas and one non-wetland waters of the U.S. mitigation site (see Figure 2-22) near the potentially impacted sites. Mitigation areas on Figure 2-22 encompass larger general locations which included the smaller actual mitigation sites. The proposed acreages and mitigation schedules for the created wetlands and non-wetland waters of the U.S. are provided in Table 2-7. Mitigation of the non-wetland waters of the U.S. would be accomplished by reconstructing the intermittent channel at its premine location during final reclamation of the mill site. The applicant's selection of the mitigation areas was based on:

- suitability for establishing similar functions and values;
- proximity to the project area;
- surface ownership;
- cumulative acreage of sites to achieve a minimum of one-for-one replacement; and
- relative cost of mitigation.

Detailed descriptions, including site development, design specifications, and schedules are presented in the applicant's Wetland Mitigation Plan (ASARCO Incorporated 1993). Most of the proposed wetland creation sites would be constructed during early mine construction, prior to destruction of the existing wetlands. The schedule would allow for some of the created wetlands to establish functions and values similar to the existing wetland resources and provide the opportunity to regrade, reseed, or redesign wetland mitigation sites if the first attempts were unsuccessful.

Surface runoff from undisturbed hillsides above the mill facilities and patio area would be diverted around the mill site and discharged to the natural channel of WRC-3 below the mill facilities area (see Figure 2-10). The diversion ditches at drainages WRC-3 and WRC-4, and unnamed tributaries to West Fork Rock Creek would be designed to handle the 100-year rainfall-on-snow event. Following the end of mining and processing activities, all diversion ditches would be removed and the areas reclaimed to their approximate original topography. Drainages WRC-3 and WRC-4 would be returned as closely as possible to their original configurations and functions (see Figure 2-21).

The borrow area 3 mitigation site would be developed into a wetland by excavating borrow material (using scrapers or a truck and shovel operation) to lower the surface elevation of the site to near that of the Rock Creek overflow channels. Excavation work would involve the construction of a series of channels with intervening ridges. Channels would be 1 to 2 feet below the ridges and would have a very low gradient (0.1 percent) sloping to the west. A buffer zone of undisturbed ground between the mitigation site and Rock Creek would be retained along the south edge of the borrow area and would be stabilized, if necessary. This site is located beyond the 100-year floodplain and away from overflow channels.



Note: WUS - Waters of the U.S.
Source: Asarco
s.ague 12-00

FIGURE 2-22
Waters of the U.S. and
Alternative II Wetland
Mitigation Sites
Rock Creek Project

Wetland hydrology for the borrow area 3 wetland would be established by excavating the channels to a depth which allows saturation and inundation of the area by seasonally high ground water. Monitoring wells or test pits would be constructed within the borrow area prior to final design to determine ground water levels and necessary depths of excavations to provide the proper wetland hydrology.

Soils on this site would be salvaged to a depth of about 13 inches. The soil would be redistributed over the mitigation site and disced or harrowed to prepare a seedbed. If available, hydric soil from the wetlands proposed to be impacted by the tailings impoundment would be salvaged and respread in the channels to increase the soil organic matter and provide a source of native plant material (soil seed bank and root sprigs). The channels would be seeded and planted with a shrub wetland mixture and the ridges with a forested/wetland mixture. One ton per acre of straw mulch would be evenly spread and crimped onto the disturbed areas. The primary functions of the created borrow area 3 wetlands would be to reduce sediment transport to Rock Creek and increase habitat diversity for wildlife and aquatic species.

Five small wetland sites would be created by the construction of a new segment of FDR No. 150. The access road wetland mitigation sites would occur where the new segment of road would cross small drainages, resulting in temporary water retention on the uphill side of the road or along the borrow ditch. Some existing wetlands, to be impacted by the access road upgrade, have been created artificially by construction of FDR No. 150. This new segment of the proposed access road crosses relatively flat terrain with several broad swales. Establishing the wetland hydrology would rely on the capture of seasonal runoff and temporary retention of water on low permeability, poorly-drained soils. The applicant estimates these mitigation wetlands would be fully inundated to an average depth of 1 foot for 3 to 4 months during snowmelt runoff (March through May or June) and partially inundated or saturated through July and August.

FDR No. 150 wetland sites would be created on the uphill side of the road by raising culverts above the base of the fill, or by using standpipes. Soil salvage details would be developed during final design based on individual site soils. A clay sealant or polyvinyl chloride (PVC) liner would be considered if the hydraulic conductivity of the soil and substrate was greater than 2.8×10^{-4} feet per day (ft/day).[6] Following grading or sealant installation, salvaged soils would be respread and a seedbed prepared. The sites would be seeded with a herbaceous wetland mixture and straw mulch applied. The primary wetland functions of the proposed access road created wetlands would be to reduce sediment transport to Rock Creek and increase habitat diversity for wildlife.

The Miller Gulch wetland mitigation sites would consist of a series of linear wetlands created along a side drainage to the South Fork of Miller Gulch. This side drainage currently does not contain wetlands but may be similar in size to other nearby drainages that do support wetlands. Establishment of wetland hydrology in the side drainage would rely on flow barriers designed to retain surface water runoff and thus increase the duration of saturation and inundation. These mitigation wetlands likely would be inundated during similar periods of the year as those created along FDR No. 150.

---

[6] For comparison, the average hydraulic conductivity of clean sand is about 28.4 ft/day; 100,000 times faster than the hydraulic conductivity rate that would trigger use of a liner.

Small retention dikes would be constructed at approximately 200-foot intervals along the full length of the side drainage of Miller Gulch. The dikes would be 30 to 50 feet long and a maximum of 5 feet high. Each dike would contain a rock-lined spillway. If the saturated hydraulic conductivity of the soil and substrate was greater than 2.8 x 10^{-4} ft/day, a clay sealant or PVC liner would be used. Hydric soils from the impacted wetland areas of Miller Gulch would be salvaged and directly respread on the mitigation sites to provide increased organic matter and a plant materials source. The sites would be broadcast seeded with a forested wetland mixture and trees and shrubs planted (ASARCO Incorporated 1993). Straw mulch would be applied. The primary wetland functions of the proposed Miller Gulch created wetlands would be to reduce sediment transport, increase aquatic and terrestrial habitat diversity and abundance, and attenuate peak flows.

The proposed Rock Creek wetland mitigation sites would consist of four linear wetlands created adjacent to Rock Creek by excavating to a depth which would allow saturation or inundation of the areas by shallow ground water. Depth to ground water (PW-6) in the mitigation area is less than 6 feet. Additional test pits would be placed in the wetland mitigation areas prior to final wetland design in order to verify ground water levels. Linear channels would be excavated with bottom widths varying from 10 to 25 feet to create a more natural configuration. Benches and shallow depressions would be constructed along the longitudinal profile to increase water retention and create zones with variable saturation and inundation. Benches would be saturated or inundated only during spring; however, the channel bottoms would remain saturated later into the growing season (ASARCO Incorporated 1993). The shallow depressions would be inundated or saturated for the majority of the growing season.

Soil salvaged from the proposed Rock Creek wetland mitigation areas would be respread on all disturbed surfaces. Respread soils would be disced or harrowed to provide a proper seedbed. Linear channels would be seeded with a herbaceous wetland mixture and the sideslopes with a upland herbaceous mix. All sites would be mulched. Wetland functions of the proposed Rock Creek constructed wetlands would be to enhance ground water recharge and discharge and increase aquatic and wildlife habitat diversity and abundance.

Alternative III — Proposed Project with Modifications and Mitigations

Alternative III (see Figure 2-23) incorporates modifications and mitigating measures proposed by the Agencies to reduce or eliminate undesirable environmental impacts. These measures are in addition to or instead of the mitigations proposed by the applicant. Proposed modifications have been developed in response to the significant issues identified during the scoping process. The seven modifications incorporated into Alternative III include a modified mine portal access route, a revised tailings impoundment design, relocation of the Rock Creek Road intersection with Montana Highway 200, changes to the road and utility corridor, an alternate rail loadout location, and an alternate air-intake ventilation adit location, and relocating the waste water treatment facility away from a proposed major wetland mitigation site. These modifications and the numerous mitigations that comprise Alternative III are described below. Many of these modifications and mitigations would also carry over into Alternatives IV and V.

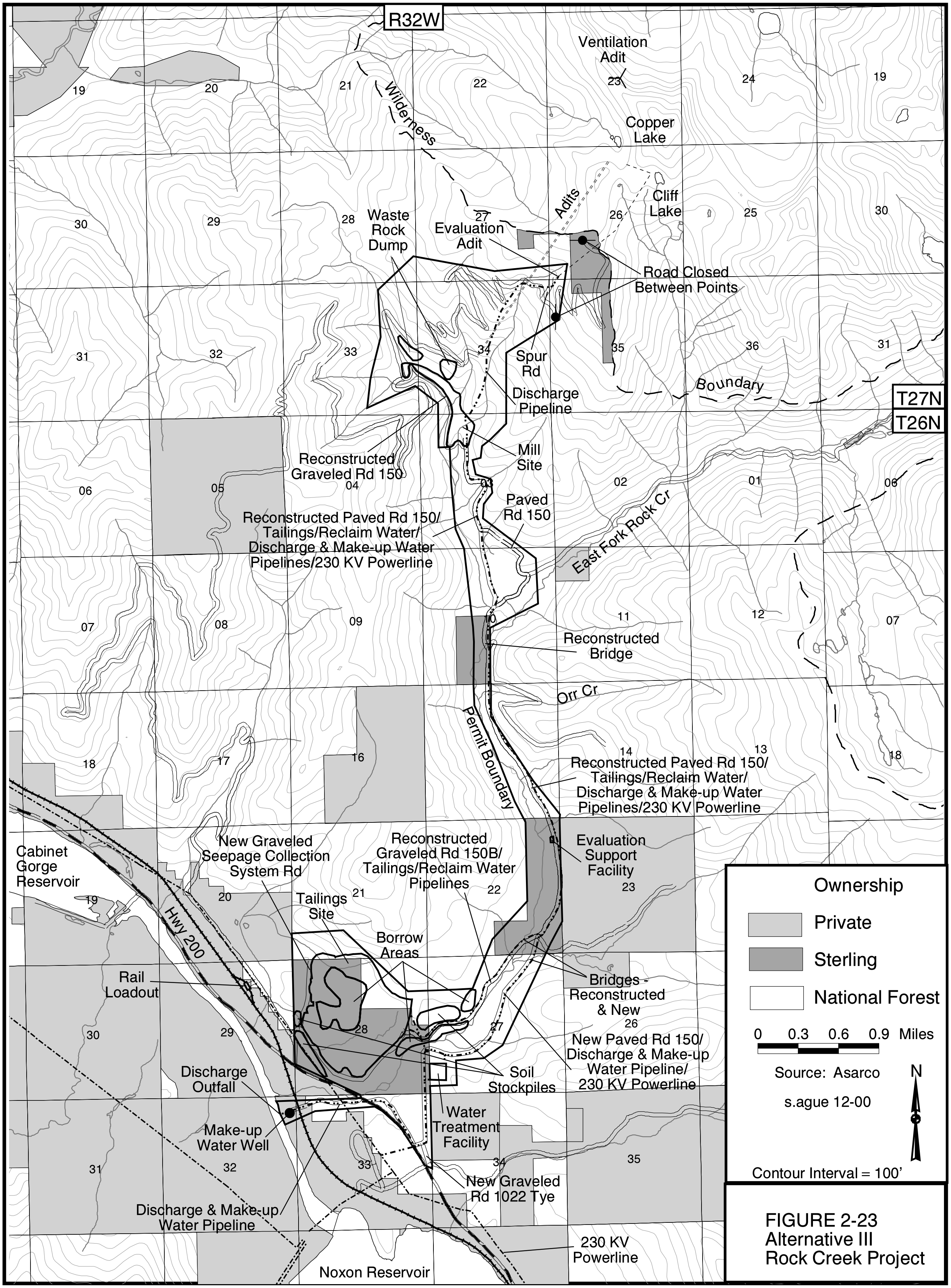


FIGURE 2-23
Alternative III
Rock Creek Project

Table 2-8 summarizes the significant issues pertinent to this project and indicates which of the following sections address modifications and mitigation measures relative to those issues. All other aspects of Sterling's mine proposal would remain as described in Alternative II. Chapter 4 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

TABLE 2-8
Alternative III Modifications and Mitigations

Significant Issues	Sections							
	Mine Plan	Ore Shipping & Transpor-tation*	Tailings Impound-ment	Water Use & Management	Utilities	Socio-economics	Reclama-tion	Monitoring & Mitigation Plans
Surface & Ground Water Quality	x	x	x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x			x		x	x
Impoundment Stability			x					
Socioeconomics								
Old Growth Ecosystems	x	x			x			
Wetland and Non-wetland Waters of the U.S.								x
Public Access/ Traffic Safety		x						
Aesthetic Qualities	x	x	x		x		x	

*This column combines two sections discussed separately below.

Mine Plan

Under Alternative III, Sterling would be required to provide for Agency review and approve an updated preliminary mine design prior to evaluation adit construction and mine start-up. The Agencies would conduct a second review of the mine design to determine its suitability for actual conditions during mine adit construction. Specifics of this review would focus on general design approach, design criteria and methodology, rock mechanics test data from the Rock Creek deposit,[7] proposed room-and-pillar sizing and layout, identification of zones of rock instability and potential subsidence, and mitigations for these areas. Given the expected changes in planning any underground mine development, Sterling would submit updated detailed mine plans for Agency review prior to entering areas where mining could have deleterious environmental impacts if adequate precautions were not taken. This would ensure development was meeting the environmental objectives and intentions of the original design. Approval of the mine plan would be contingent on demonstrating that the risk to Copper and Cliff lakes would be minimized, based on hydrogeologic and applicable engineering analyses. Secondary pillar recovery would not be allowed.

Aesthetic impacts of the mill and mine-related facilities would be minimized because ASARCO would be required to implement the following mitigations:

[7] Rock mechanics data would be obtained during construction of the evaluation adit.

- plant or retain a vegetative buffer of sufficient width between FDR No. 150 and the evaluation adit support facilities, the passive biotreatment facility, and the substation in the lower Rock Creek drainage for visual screening;

- treat and/or paint permanent (life-of-mine) structures within the project area to visually blend with the surrounding landscape;

- shield or baffle exterior evaluation adit lights from viewpoints in the Clark Fork Valley;

- deposit waste rock in two dumps on hillsides adjacent to the mine adits in existing clearcuts (see Figure 2-23). Adjacent vegetation would be retained to the extent possible;

- retain or plant trees to screen the northeast hillsides above the mill, and operate all surface and mill equipment so that sound levels do not exceed 55 dBA measured 250 feet from the mill;

- replace above-ground vehicle back-up beepers with discriminating back-up alarms that sense movement behind a vehicle; and

- adjust intake and exhaust ventilation fans in the exploration and mine adits so that they generate less than 82 dBA measured 50 feet downwind.

Sterling could have two ventilation adits other than the mine adits; the evaluation adit for air exhaust ventilation during the operation phase and the proposed air intake ventilation adit in the wilderness near year 20 (only if necessary to meet MSHA standards). A process would be developed to ensure locating an air intake ventilation adit in the CMW would be the last choice among potential ventilation options. Other options could include an upgrade of the existing ventilation system and closure of portions of the exhausted underground workings. If Sterling and the agencies determine that other methods of expanding ventilation capacities are reasonable Sterling would implement other ventilation techniques prior to being permitted to construct the wilderness adit/portal. If it was deemed necessary to construct the air intake ventilation adit in the CMW, Sterling would conduct a detailed study verified by a site visit with the Agencies prior to excavation to evaluate variations in topography and rock formations. Other site-selection criteria would consider possible post-closure use of the adit for bat habitat. The Agencies would evaluate the compatibility of this post-mine use with restoration of premining appearance and configuration to address visual impacts. For purposes of analysis in this EIS, the Agencies have assumed that the air intake ventilation adit would be relocated about 400 feet north of the west ridge of Saint Paul Peak and would disturb about 800 square feet. The wilderness air intake ventilation adit would be located so as to minimize visual impacts and reduce noise impacts to 45 dBA (measured 50 feet from the ventilation portal). If necessary to achieve this level, specially designed low-noise fan blades or active noise-suppression equipment would be used.

Sterling would install the portion of temporary mine water discharge pipeline between the evaluation adit and FDR No. 150 with a cable and winch instead of dragging it through the woods with a tractor. This would minimize vegetation clearing and erosion on the steep hillside below the evaluation adit.

Surface Disturbance

A total of about 608 acres will be disturbed within the permit area for Alternative III (see Table 2-2). The Forest Plan would be amended to make management area allocations on 197 acres consistent with the intended use.

Ore Production Scheduling

Ore production and scheduling would remain the same as described for Alternative II. The mine would produce 10,000 tons of ore per day with an anticipated 31.5- to 35.5-year mine life (see Table 2-11 in Alternative IV description).

Ore Shipping

The rail loadout would be located to the south of Miller Gulch, west of the tailings impoundment and just north of Montana Highway 200, along Montana Rail Link's mainline. The concentrate would be hauled to the loadout via FDR No. 150 to FDR No. 150B around the impoundment and then to Government Mountain Road. This would eliminate ore truck traffic on the highway and would locate the loadout away from houses (see Figure 2-23).

Tailings Impoundment

Impoundment Construction. The applicant offered an alternative tailings impoundment design to address the stability issues of resistance to seismic liquefaction, phreatic surface control, and soft foundation conditions (Dames & Moore 1993). This tailings impoundment would be raised using a combination of the centerline and upstream methods known as the modified centerline method (see Figure 2-3). For the first 7 years, the impoundment would be constructed using the centerline technique followed by the upstream method for the remainder of the facility life. The alternative design would also include compacting the tailings beach to the density required to resist liquefaction, possible removal of soft clay underlying portions of the dam, and a concrete shear-wall to improve sliding stability under one of the starter dams. The impoundment was designed to withstand a 7.0 magnitude earthquake occurring on the Bull Lake Fault. This design is described in *Revised Alternative Impoundment Design* (Dames & Moore 1993) and is discussed in Appendix G.

Sterling would use some waste rock from mine adit construction for the starter dams and foundation materials. This would eliminate the need for developing borrow area 2 if the volume was sufficient from the waste rock borrow areas 1 and 3 and could be economically transported.

The tailings impoundment design would be finalized as additional site information was obtained from the final design investigation process. Technical review of the final design would be made by a review panel established by the Agencies. The technical panel would consist of agency specialists and staff from interested federal, state, and tribal agencies.

The panel would be charged with reviewing the final design for the tailings impoundment as developed by the applicant offering critical comments and suggestions. Review would encompass the technical aspects of design including the short- and long-term stability of the embankment. If geochemical testing showed a potential for acid generation, the review would also include consideration of some form of liner beneath the impoundment. The panel would ensure that any environmental impacts associated with final design remained within the scope of those impacts identified in the final EIS. If the final design generated additional impacts and they could not be mitigated to remain within this scope, then further MEPA/NEPA documentation would be required. The Agencies would review and approve the final design prior to construction.

Embankment Drainage. Impoundment drainage in Alternative III would be controlled in part by the 200-foot-wide shell of free-draining sand placed on the outside of the embankment. This would maintain the pond no closer than 400 horizontal feet from the dam crest. There would be no need for blanket drains on the starter dams as in the proposed alternative because of the modified centerline design. The intercepted water would be collected and returned to the impoundment via seepage collection trenches and ground water capture wells.

If preliminary rock and tailings characterization data suggest that these materials would contribute to acid rock drainage, alternative seepage preventative measures such as lining the impoundment with a seepage-inhibiting layer or material would be investigated. The results of this study would be incorporated into the final impoundment design to be reviewed by the technical panel.

Tailings Impoundment Seepage. If suitable, clay material excavated at the location of the proposed tailings impoundment embankment would be used to seal (line) the colluvium (soil deposited by gravity) at the north end of the proposed tailings impoundment, and other areas of the impoundment footprint that would be underlain by materials of higher permeability. Clay also could be stored, if necessary, based on acid base accounting during exploration, for use at a later date to help reclaim waste rock piles.

Additional ground water quality sampling would be conducted at specified monitoring wells prior to construction of the proposed tailings facility to document water quality conditions in the tailings facility footprint downgradient of the decommissioned Noxon sanitary landfill. Samples would be analyzed for physical parameters, nutrients, common ions, metals, volatile organic compounds and semi-volatile organic compounds. If the results of sampling indicate the landfill is a potential source area for contamination, appropriate steps would be taken to mitigate the potential for additional problems in the future. Mitigative measures could include, but not be limited to covering the landfill area with an impermeable synthetic material to reduce commingling of tailings leachate with landfilled materials.

Water Use and Management

A detailed water balance would be refined annually for estimating water use, seepage, and discharges. Actual volumes for a number of water balance variables would be measured to update previously projected calculations. These would include measurements of precipitation; evaporation; mine and adit inflow, outflow, and storage; inflow to the tailings impoundment; seepage from the tailings impoundment; seepage collected by the perimeter recovery system; outflow to the passive biotreatment system; and discharge to the Clark Fork River.

The Agencies would require long-term monitoring and maintenance, and possible long-term post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

Transportation

Sterling must submit a traffic management plan to reduce total average daily traffic (ADT) to the mill site. This plan would address both construction and operation mine-related traffic (excluding public recreation, Forest Service, and logging traffic).

The intersection of FDR No. 150 and Montana Highway 200 would be relocated to meet applicable MDT siting requirements. The alternate route for FDR No. 150 (see figures 2-18 and 2-23) would intersect Montana Highway 200 about 0.23 miles west of FDR No. 1022 (McKay Creek Road). This route would then proceed westerly and northerly over NFS lands and Sterling land to tie back into FDR No. 150 just north of the Engle Creek Road intersection. This alternate road would need to be constructed prior to closure of existing FDR No. 150 near the tailings dam area. Sterling would time its road closure schedule for FDR No. 150 to accommodate essential local access needs.

Sterling would reroute access to the mine portal to minimize or eliminate slumping potential of the hillside at it's proposed location and to reduce impacts to old growth habitat. Access to the portal would be via FDR No. 150, FDR No. 2741, and an existing unnumbered spur road (see Figure 2-19). Specifications of the road would be as follows:

- FDR No. 150 (14-foot-wide dirt road) from north of the mill site to the junction of FDR No. 2741 (about 0.19 mile) would be reconstructed to a two-lane 24-foot-wide gravel road.

- FDR No. 2741 from the junction of FDR No. 150 to the spur road (about 1.25 miles distance) would be reconstructed to a two-lane 24-foot-wide gravel road. The unnumbered portal spur road would be reconstructed for 0.19 miles to a 14-foot-wide gravel road.

A travel lane would need to be maintained for traffic on FDR No. 150 during road construction and reconstruction. Sterling would need to develop a traffic plan to allow private landowners reasonable access to their property, and public access to NFS lands. In addition, emergency medical access to the mill and mine sites would need to be considered in the plan.

FDR No. 150B, the proposed road around the south end of the tailings impoundment, would be constructed/reconstructed for 1.7 miles to a single-lane road (14-foot-wide paved road) with turnouts suitable for ore truck traffic.

Bridges to be constructed or reconstructed over Engle and Rock creeks would be realigned nearly perpendicular to the stream. Road closures are described in the Threatened and Endangered Species Mitigation for this alternative.

Utilities

Sterling would use a single utility corridor along FDR No. 150 for all pipelines and for the proposed 230 kV powerline. The tailings slurry lines would be above ground and both water pipelines would be buried as described for Alternative II.

Sterling would construct 6.6 miles of 230 kV transmission line with wood pole, dark porcelain or polymer insulators, and nonspecular conductors to reduce contrast. From Montana Highway 200, the powerline would parallel new FDR No. 150 until it intersected existing FDR No. 150. It would continue parallel to FDR No. 150 to the mill site except for a cross-country segment above the confluence of the east and west forks of Rock Creek.

Sterling would use the following measures to reduce right-of way clearing and help produce a feathered, more natural-appearing edge of timber along the utility and road corridor. These measures would be applied to appropriate segments of the corridor during the design phase:

- retaining non-hazardous trees and brush on the right-of-way;
- cutting trees at ground level to reduce visibility of stumps;
- disposing of felled material with the least possible impact on remaining vegetation; and
- selective clearing of timber adjacent to the corridor to soften the edge between cleared and uncleared areas.

Erosion and Sediment Control

In addition to the Best Management Practices (BMP) originally proposed by the applicant, a vegetation management plan would be developed to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments.

Adit Closure

The adit closure plan would need to be finalized and submitted to the Agencies for review and approval prior to mine closure.

The evaluation adit would be plugged with reinforced concrete at mine closure. Since this adit would be a decline and the portal is above the water table, the purpose of the plug would be primarily to close off access and eliminate any potential for surface water inflow.

The service and conveyor adits would be plugged with reinforced concrete near the elevation of the orebody within the mine. This would prevent 1,150 feet of water pressure that would develop if adit seals or plugs were placed at lower elevations in the adits. The adits would be closed at the portal with non-mineralized waste rock to prevent access. Drainage from the portal (inflow to the adits below the elevation of the plugs) would be treated until it meets water quality standards without treatment at which time it would be channeled into WRC-3 (or 4) and allowed to drain into the West Fork of Rock Creek or infiltrate into the mill pad. Monitoring data would be used to establish discharge requirements prior to the time of adit closure.

In addition to adit closure described under Alternative II, Sterling would develop a plan to restore the air intake ventilation adit within the CMW to its premining appearance and configuration following mine closure. Rock from adjacent areas and/or waste rock treated with oxidating compounds would be used for the surface closure to replicate natural conditions and appearances. Sterling would investigate the potential for creating bat habitat at both the evaluation and air-intake ventilation adits. Depending upon the results of the study, agencies may require modification to adit closure plans to accommodate bats.

Reclamation

Short and long term reclamation objectives would remain the same as for Alternative II. These would be achieved through interim and final reclamation of all disturbed sites as described for Alternative II with additional mitigation described below and implementing all erosion and sediment control measures described for Alternative II.

Postmining Topography. Regrading plans for each facility would need to be developed by Sterling to reduce visual impacts of reclaimed mine facilities. All of these plans which are described below would require Agency review and approval prior to implementation.

Sterling would regrade the evaluation adit waste rock dump to approximate existing contours at the end of operations, eliminating any bench at the adit portal. Waste rock from the lower Revett Formation,[8] a rock formation with similar characteristics to surface rock, would be used for the surface layer of the dump, especially for the portion that would be left unvegetated. If necessary to meet visual quality objectives, waste rock surfaces that remained exposed after reclamation would be treated with oxidizing compounds to blend them with adjacent talus (Reynolds 1995). Where possible, existing trees at the outer edge of this talus slope and existing pockets of trees and shrubs within this talus slope would be retained and would not be damaged during dumping. Reclamation of the evaluation adit portal would be the same as described for Alternative II. If stockpiled ore at the evaluation adit proved uneconomical to process, Sterling would develop a plan, subject to review and approval by the Agencies, to dispose of the ore in conjunction with reclamation of the evaluation adit.

Sterling would develop a design, with approval by the Agencies, to recontour faces of the tailings impoundment to more closely blend with the surrounding landscape. This design would incorporate additional fill at selected intersection points of the impoundment and adjacent landforms, use waste rock in selected locations to create a coarser surface texture, and use benches in some locations to facilitate tree and shrub plantings. To the extent possible, the linear edges, horizontal crest, and uniformly sloping faces of the impoundment would be recontoured into a series of undulating forms that blended into the surrounding landscape. Whenever possible, these features would be developed during impoundment construction to reduce the amount of regrading during reclamation. The regrading plans incorporate all applicable portions from Alternative II as well as include plans for regrading all related facilities including the pumpback well system, water treatment plant, and borrow areas.

Sterling would develop plans to shape slopes of the mill site, waste rock dumps, and mine portal areas to more closely resemble the surrounding landscape. A portion of this would be achieved during construction of the mill site and waste rock dumps. The remainder of the work would be done during the reclamation phase and would involve regrading and shaping flat surfaces to blend with the adjacent landscape. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms. If necessary to meet visual quality objectives, rock surfaces that remained

---

[8] This rock type would be the last waste rock removed from the evaluation adit. Due to variations in rock types within the formation, it may be necessary to stockpile quartzite material that closely resembles surface talus to blend the new rock dump with the existing talus as much as possible. This material would be stockpiled on the bench or stored in the adit until ready for deposition as the final layer on the rock dump.

exposed after reclamation would be treated with oxidizing compounds to blend them with adjacent talus. Regrading plans for the utility corridor would be modified to account for the changes from Alternative II.

Vegetation Removal and Disposition. The mining company must prepare a Vegetation Removal and Disposition Plan that deals with the potential uses of vegetation removed from areas to be disturbed. The plan must detail disposition and storage plans during mine life. The vegetation debris piles and surface lift soil piles containing large quantities of organic debris should be stored in carefully selected storage sites to prevent off-site impacts from the production of low quality organic acids as the materials begin to decay. See soil storage site recommendations in the Soil Salvage and Handling section below.

Where possible, slash from timber-clearing operations would be salvaged for soil protection. Large or whole pieces could be used as physical barriers and catchments and ground-up slash would be used as mulch or as an additive to stored topsoil. Large or whole pieces could also be used to enhance or create desirable fisheries habitat in Rock Creek according to aquatic/fisheries mitigation plans. All mulching materials would be certified weed-seed free.

Soil Salvage and Handling Plan. Soil salvage and handling methods would be similar to the applicant's project and evaluation adit proposals (Alternative II). Soil volumes are different due to changes in road and utility locations (see Figures 2-18 and 2-23) and deeper soil salvage. The expanded sediment reduction soil salvage and handling plan would include means to ensure that handling losses were minimized and that direct-haul methods were maximized. Also, the timing and sequencing of stockpile use (for respread) would be detailed to ensure that visual impacts would be mitigated (see Scenic Resources, Chapter 4).

Soil stockpiles would be incrementally stabilized (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Soil stockpiles would have organic matter added to help retain soil quality. Seeding would be done as soon after disturbance as possible rather than waiting until the next appropriate season. Immediate seeding of road cuts-and-fills has reduced erosion on Forest Service roads regardless of planting time (pers. comm. L. Kuennen, USFS with P. Plantenberg, DEQ, February 14, 2000). Sediment traps would be used downslope where necessary to minimize soil movement.

To enhance tailings impoundment reclamation, soils would be salvaged from the tailings impoundment area in two lifts. The first lift would be the more suitable topsoil as proposed by the applicant. In addition, a second lift would be excavated up to 36 inches; this would be respread over the prepared impoundment surface first. Beach materials (sandy tailings) that would accumulate at the edge of the impoundment could be respread over the slimes before soil distribution and planting preparation. Replaced soil depths would average 24 inches over the tailings impoundment and would be distributed in two lifts.

Soils in the impoundment area would be stockpiled and replaced separately on two geomorphic landforms in the impoundment footprint: the large flat tailings impoundment surface area and the 33 percent sloping embankment face. To limit erosion potential, the soils in the impoundment footprint would be classified and stored in different piles based on the proposed reclamation use. Two classes of erodibility would be established by the agencies based on the soil survey data.

The least erodible colluvial soils from slopes greater than 8 percent would be used on the impoundment face to limit erosion potential. These soils would be stockpiled in two lifts for use as subsoil and topsoil in the reclaimed dam face.

The soils with the greatest erodibility, primarily lacustrine soils on slopes less than 8 percent, would be used on the relatively flat tailings surface. Soils would be stockpiled in two piles for two lift replacement.

Colluvial subsoils over and above the volume needed for soil replacement depths would be stockpiled for use in producing the geomorphic variability required under mitigations discussed in the Postmining Topography section for the embankment face.

These stockpile volumes would be identified by the agencies and the piles would be signed based on the use in the postmining landscape.

Sterling would use soil from the stockpile located southwest of the impoundment (S-1) for reclamation activities before using S-2 (east of the impoundment, see figures 2-13 and 2-23). After S-1 was depleted, this area would undergo final revegetation with shrubs and trees for visual screening from Montana Highway 200.

Recontouring of the impoundment dam face (see Postmining Topography) also would allow additional soil to be placed where slopes were less than 33 percent. Again, this would provide variability to the new soils, thus enhancing establishment of planted species and aiding in reintroduction of and colonization by native species.

Topsoil salvaged mainly from the mill site would be respread over all of the facility areas because little soil is available in the waste rock dump and portal areas. DEQ requires salvage of rocky soil (less than 50 percent rock fragments) if it is characteristic of the area. Sterling would use the two-lift approach for the mill site area where soils are generally deep, and would salvage soils deeper (up to 36 inches) than proposed in Alternative II. Soil replacement depths at the mill site would be at least 24 inches. Shallow and rocky soils would also be salvaged at the portal and waste rock dump site. Soils replacement depths would range from 0-24 inches in the mine portal and waste rock dump areas.

Soil depths on the rest of the disturbances would be the same as described for Alternative II.

Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding for best seed establishment. Where soil fertility may be low and tilth poor, organic matter (weed-free aged manure, compost) would be incorporated into respread soils before planting.

Two-lift Soil Salvage and Handling in Forested Environments. In forested soils, it is advantageous to stockpile the surface organic and mineral horizons and store them separately from subsoil mineral horizons (Soil Quality Criteria Working Group, 1987). Ideally, this would mean that the surface 6-12 inches of organic materials and soil would be separated from the subsurface 12-18 inches of soil in a 24 inch soil replacement profile. To pick up a uniform 6-12 inch organic and mineral layer in a forested setting is not practicable. The following sections describe the process in more detail.

Sterling would be required to submit a revised soil salvage and handling program that deals with two lift salvage and storage practices and concerns over water quality, and direct haul soil replacement on acreages reclaimed during mine life.

First Lift Removal And Storage. By the time the site has been cleared of vegetation, as described above in the Vegetation Removal and Disposition section, the surface of the cleared area is a mixture of several horizons, largely because of the amount of disturbance required to remove stumps from the area. The surface lift soil that ends up in the stockpile would be a mixture of the left over slash that has been left on the soil surface, the majority of the organic soil horizon, most of the surface mineral horizon, and decreasing amounts of the subsurface mineral horizons.

The first lift salvage program would continue and the volumes removed would be monitored until the volume removed is equivalent to replace 6-12 inches per acre on reclaimed acres. At least a 25% correction factor should be figured into the volume factors to account for settling of the organic material in the stockpile over time and waste in handling.

Because of observed problems with the large amount of vegetation in forest surface soil stockpiles at other mine sites in Montana, the agencies would require site specific evaluation of final soil storage locations to identify proximity to surface water and ground water sources. If the storage site is less than 6 feet to ground water or the site is within 300 feet of surface water, then the surface lift soil stockpiles may need to be amended with lime to prevent development of potential seeps containing low pH fluids from decay of coniferous vegetation in the salvaged soil and elevated metals leached from salvaged soil during storage.

This lime amendment would be based on review of soil testing of pH and organic matter contents and would be designed at rates that would maintain the pH in the stockpile above 5.5 (Brown 1995). One sample should be taken for each 10,000 cubic yards of soil in the stockpile or a minimum of 3 samples per stockpile. If the site is farther away from water than the distances listed above, then a sampling well may be needed to monitor for changes in ground water during the storage period.

Second Lift Removal and Storage. The subsoil lift would begin once the surface lift volumes have been removed and verified on a per unit area basis. The remainder of the soil to be salvaged on a volume per unit area basis would be removed to the stockpile site or direct hauled to acres ready for subsoil replacement.

The subsoil lift stockpiles would have less organic matter and would not be subject to the same potential organic acid problem. But, if the pH of the subsoils is less than 5.5, a lime amendment may be needed to limit solubility of aluminum, manganese and other metals which could be toxic to plants (Soil Quality Criteria Working Group 1987) or which could affect water quality based on proximity to surface and ground water sources. These are natural metals in the forest soils of the area and not related to mining wastes. One sample should be taken for every 10,000 cy of subsoil or a minimum of 3 samples per stockpile to document baseline metal values. The stockpiles should be planted with the final revegetation mixes.

Direct Haul and Temporary Storage of Soil. Direct haul soil salvage and replacement would be required for use whenever and as much as possible to enhance revegetation success of native unseeded species (Prodgers and Keck 1996). Most soil would have to be stockpiled. Areas such as road cut-and-fill slopes, powerline pole locations and access roads, and other disturbances that would remain postmine should be reclaimed as soon as final grades are achieved with direct haul soil or soil that has been stockpiled for less than one year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface (Prodgers and Keck 1996).

Revegetation. After year 7 of impoundment construction, Sterling would apply a tackifier or hydromulch/seeding (with color additive) to each lift of the impoundment following construction and prior to final reclamation. This would reduce contrast of the sand tailings with the adjacent vegetation; hydromulching/seeding also would provide interim erosion control. Color of the additive would be subject to Agency approval.

Sterling would develop a detailed final planting design for all disturbed areas including the area between the impoundment footprint and the highway. Final designs would avoid uniform distributions of plants, with planting densities, species selection, and their distributions repeating natural patterns in the surrounding landscape. A combination of planting designs, natural mortality, and possible thinning of thick tree stands would achieve a natural-appearing mosaic of vegetation on reclaimed areas. Forest Service standards for revegetation would be required on NFS lands.

Weed seed-free seed mixes would be modified to include grass and forb species suited for quick stabilization as well as those needed for long-term wildlife habitat needs. Locally collected seeds and plants would be used whenever possible.

Sterling would develop a phased final reclamation and revegetation plan for faces of the tailings impoundment during the operational phase. Phased tree-planting, initiated before the end of operations, would allow the impoundment to blend with the surrounding landscape more quickly. The design for the impoundment faces would incorporate varying densities of shrubs and trees. Final design would be coordinated with grading and regrading plans and be implemented early to minimize redisturbance after revegetation. Tree planting could be started after year 7 when upslope construction began and would occur about every 2 to 4 years thereafter. Trees and shrubs would be hand planted on slopes exceeding 33 percent but could be mechanically planted on flatter slopes.

Trees would be planted adjacent to Montana Highway 200 soon after Agency permits were approved. This would facilitate earlier visual screening of the impoundment from the highway.

Sterling would plant native shrub species at the evaluation adit site. Earlier successional tree species such as larch, western white pine, and spruce would be planted. The grass seeding mix and talus component proposed for reclamation combined with these trees would better meet the needs of wildlife and visual resources. This modification to the seeding mix/planting rates would be subject to Agency approval. See Appendix J for suggested approaches.

Successful establishment and growth of trees are necessary to obtain the greatest visual mitigating effects on and adjacent to mine facilities. Given the importance of mycorrhizal fungi for tree growth and establishment, Sterling would obtain locally grown tree seedlings from an appropriately inoculated soil medium. Legume species would be inoculated with appropriate nitrogen-fixing bacteria. Other methods such as transplanting native shrubs and/or very small trees could be proposed. Fertilizer requirements and planned fertilizer applications would be carefully calculated to minimize nutrient losses due to deep leaching.

Shade cards or other methods would be used to protect tree and shrub seedlings, especially on south- and west-facing slopes of the impoundment and mill site. New tree and shrub plantings would be protected from wildlife browsing by netting. Drip-irrigation would be used during April through early June for up to three years after planting trees and shrubs on the impoundment face to help with plant establishment.

If tests of the contents of the biotreatment cells indicated a potential metals problem then substrate would be removed from the biotreatment cells at closure and enclosed in a geomembrane lined cell in the impoundment. The substrate would be buried in the impoundment under a graded compacted layer of at least 6 feet of tailings near the embankment face. Topography in the area of the cell would be mounded to prevent excess water from potentially moving through the substrate.

Reclamation of the mounded tailings over the biotreatment cell substrate would be completed by applying a minimum of 24 inches of soil, followed by revegetation. The biotreatment area would be backfilled with clean subsoils to a mounded configuration to produce an area which will limit infiltration through the old cell areas. Then the mounded subsoil area would be covered with a surface lift of soil and revegetated. Bond would be calculated to cover this reclamation modification and would include the salvage and storage of the materials needed to complete the reclamation at mine closure.

Monitoring and Mitigation Plans

The following monitoring and mitigation plans would be coordinated to reduce conflicts and avoid duplicate requirements. They would be subject to Agency review and approval.

Rock Mechanics Monitoring. Sterling would submit a separate surface and underground monitoring and testing plan once underground development had progressed enough to establish monitoring points. Its purpose would be to define the existing geologic stress field and its response to underground mining. The plan would specify monitoring equipment, locations, and frequency of monitoring and reporting, and define types of laboratory tests and frequency of testing. The information would be used in planning the size and location of underground openings and support pillars, identifying locations needing additional support and areas to be avoided for final mine development, and for making predictions about long-term behavior of the underground rock mass. Once mining was underway, Sterling would be required to submit detailed mine development plans in advance of entering areas of suspected rock instability as identified in the preliminary design and during the underground monitoring program. These reviews could result in Sterling leaving more in-place ore for support than was originally intended, or conversely the information could suggest areas where pillars could be removed without jeopardizing the long-term stability of the site.

Acid-Base Testing and Monitoring Plan. The potential for acid drainage cannot be conclusively determined from baseline data but it is not expected, based on the similarity of site conditions to the Troy Mine site. Additional data collected during exploration, mine development, and operations would be required to refine predictions of the potential for long-term acid drainage, and to assess the acid drainage potential of waste rock prior to its use as construction material. A representative underground sampling and acid-base testing and monitoring program would be developed and implemented on rock from the adits, ore zones, above and below the ore zones, and in the barren zone. The results would help identify materials to be segregated to prevent production of acid leachate or drainage.

Water Resources Monitoring Plan. Sterling would submit a comprehensive long-term surface and ground water quality monitoring program (see Appendix K). Data collected from the monitoring program would be reviewed to evaluate the extent and magnitude of potential impacts during the proposed project's construction, operation, and postoperational periods. In conjunction with this plan, a Monitoring Alert Levels and Corrective Action Plan would be developed to ensure early detection of potential environmental degradation. The plan would identify alert levels, which when exceeded, would trigger a contingency or corrective action to be implemented.

Long-term postoperational surface water monitoring of streams and springs would continue until the Agencies determined that water quality met state standards. Sampling stations would be located primarily on the main stem and east and west forks of Rock Creek, Miller Gulch, and the Clark Fork River.

Long-term postoperational ground water monitoring would focus on tailings impoundment seepage and ground water quality inside and outside the permitted mixing zone. Monitoring wells associated with the proposed seepage interception system would provide data to evaluate the system's effectiveness. Additional monitoring and interception wells may be added if monitoring showed degradation outside the approved mixing zone. Adit and mine discharge and seepage through the waste rock dump and mill pad also would be monitored.

Monitoring of lake levels would occur at Cliff and Copper lakes because mining could cause fractures that may extend to the surface thereby affecting lake levels although the potential for subsidence is small. If increased seepage was noticed in the mine workings, mining in the affected section would be halted and the problem investigated. The lakes would be visited and continuous lake level data would be retrieved and analyzed. During this period, additional grouting would be required. Upon further data analysis, more measures could be required to lower the seepage rate. A plan to mitigate impacts to wetlands potentially affected by draining of these lakes would be developed as part of the applicant's wetlands mitigation plan.

Assuming adit portals could not or would not be permanently sealed, postoperational adit flow would be discharged to the Clark Fork River via the water treatment system until it met water quality standards without treatment. Monitoring would be continued according to MPDES requirements. Sterling would investigate and fund alternative measures to ensure adit plug stability and postoperational adit water treatment.

Wildlife Mitigation and Monitoring Plans. The applicant's fish and wildlife mitigation plan would be modified to incorporate the following measures:

- monitoring closed roads (Chicago Peak and Orr Creek roads) to determine if inappropriate use was occurring;
- creating bat habitat in the evaluation adit, if determined to be appropriate by the Agencies; and
- using selection criteria for the air-intake ventilation adit site in the CMW that would help minimize impacts to mountain goat habitat.

A wildlife monitoring plan found in Appendix K would be developed to:

- coordinate with other programs to assess impacts to neotropical migrant birds;
- assess mountain goat population trends, habitat use, and responses to mine-related impacts in cooperation with MFWP; and
- assess sensitive species for population trends, habitat use, and responses to mine-related impacts in cooperation with KNF.

Aquatics and Fisheries Mitigation and Monitoring Plans. A conceptual monitoring plan is found in Appendix K. Sterling would be required to monitor impacts to benthic macroinvertebrates, fish populations, and periphyton. Metals accumulations in fish tissues, and increases in sediment loads would also be monitored. Additional monitoring sites would be required. Monitoring for sediment sources during construction would be conducted under the reclamation monitoring plan found in Appendix K.

A mitigation plan would be required to address maintaining populations of threatened and sensitive aquatic species and to reduce sediment in spawning gravels. The plan would include a survey to identify sediment sources, and methods of reducing them both within and outside of the permit area, upstream of spawning areas, during or prior to mine construction. The survey and sediment reduction plan would include Rock Creek.

Sterling would be responsible for mitigating sediment sources within the Rock Creek watershed on NFS lands equivalent to 130 acres.[9] Sediment source reduction activities would be completed during the construction period, if possible.

An unaltered vegetation zone would be left between Rock Creek and the road and utility corridors, where possible during new construction, to protect bull and westslope cutthroat trout habitat. Sediment catchment basins would be installed in road ditches in areas where fine sediments could be transported to streams from application of sand during winter. Mitigation plans for chemical spills and tailings pipeline rupture would be developed, prior to mine operation.

Threatened and Endangered Species Mitigation Plan. The following items would be required to reduce or eliminate consequences to species federally listed as threatened or endangered.

To reduce mortality risk to threatened and endangered species Sterling would:

- not use salt when sanding during winter plowing operations to reduce big game mortality that could draw bald eagles, wolves, and grizzly (in spring) to the road corridor and increase mortality;
- remove road-killed animals daily from road rights-of-way within the permit area and along roadways used for access or hauling ore. Road kills would be moved at least 50 feet beyond the right-of-way clearing and further, if necessary, to be out of sight from the road;

[9] This acreage is the sum of the amount of NFS lands associated with the tailings pond, the soil stockpile site, the access road, the tailings line corridor, emergency impoundments, and the exploration mine entry patio, and waste rock dump.

- work with other mines operating in the area (e.g., Noranda) to partially fund a public information and education program to aid in grizzly bear conservation. This would be the same program as required in the RODs for the Montanore Project, not an additional one. The program would be funded for 5 years and then evaluated for need to continue or modify to better benefit grizzly;

- work with other mines operating in the area (e.g., Noranda) to partially fund a local MFWP law enforcement position for the life of the mine. This would be the same position as required in the RODs for the Montanore Project, not an additional one;

- bear-proof all project-related containers holding attractants and remove garbage in a timely manner;

- prohibit employees from feeding wildlife, especially bears;

- develop a transportation plan to minimize mine-related vehicular traffic traveling between Montana Highway 200 and the mill site, and minimizing parking availability at the mill site;

- not use clover in the seed mix used on any disturbed areas during mine operation; and

- prohibit employees from carrying firearms within the permit area, except for security personnel.

To maintain habitat effectiveness for threatened and endangered species, Sterling would:

- secure or protect (through conservation easement or acquisition) replacement habitat to compensate for acres lost by physical alterations or acres with reduced habitat availability due to disturbance; 2,692 replacement acres would be required;

- work with private and corporate landowners within and adjacent to the Rock Creek drainage to close their roads to benefit grizzly bears;

- fund grizzly bear habitat enhancement activity on 609 acres that include but are not limited to prescribed fire; and

- fund 4.18 miles of road closure.

To reduce mortality risk and maintain habitat effectiveness for threatened and endangered species, KNF would close 1.88 miles of FDR No. 2741 (Chicago Peak Road), 1.61 miles of FDR No. 2285 (Orr Creek Road), 0.51 miles of FDR No. 2741A, and 0.18 miles of FDR No. 2741x. Sterling would construct a new trailhead with parking space for at least 5 passenger vehicles at the new closure point of Chicago Peak Road.

Reclamation Monitoring Plan. More intensive monitoring would be required by DEQ and KNF. A monitoring plan would address reclamation/soil stability during mine life as well as after closure. Since establishment of trees takes 5 to 7 years at a minimum, Sterling would carry out a long-term monitoring program for up to 20 years after mine closure. Specific measures would include:

- monitoring soil salvage and replacement to verify depth and suitability;
- inspecting for erosion in spring and fall and after heavy rain and implementing immediate erosion-control measures, if necessary;
- monitoring construction activities to identify sources of erosion and to audit implementation of BMPs;
- conducting soil chemical tests to identify soil nutrient needs or toxicity problems prior to respread of soils and in areas of poor revegetation; and
- inspecting all seeded and planted areas annually during the active growing season to identify poor plant growth or damage and implementing remedial actions.

Wetlands Mitigation Plan. Sterling would mitigate impacts to 6.2 acres of wetlands and 1.5 acres of non-wetland waters of the U.S. (see Table 2-6). Diversion of the 1.5 acres of non-wetland waters of the U.S. would be constructed so as to maintain premine functions and values. The proposed relocated segment of FDR No. 150 would directly affect Sterling's proposed location of 1.8 acres of the "access road wetland mitigation sites." This relocated segment would not cross the small drainages and would not capture the seasonal runoff necessary to establish and maintain wetlands. The remaining 10.5 acres of wetlands mitigation sites proposed by the applicant would still be available for use. Other locations within the riparian areas along Rock Creek and within the proposed permit area might have the necessary wetland hydrologic characteristics to replace FDR No. 150 mitigation site acres. Sterling might be required to identify additional mitigation sites to comply with its 404 permit. A plan, required by COE as part of the 404 permit, would be developed to mitigate impacts to wetlands associated with Cliff and Copper lakes if subsidence should cause the lakes to drain. An aquatic life mitigation plan would be prepared in conjunction with the wetlands mitigation plan for wilderness lakes.

Additional ground water quality sampling would be conducted at specified monitoring wells prior to construction of the proposed tailings facility to document water quality conditions in the tailings facility footprint downgradient of the decommissioned Noxon sanitary landfill. Samples would be analyzed for physical parameters, nutrients, common ions, metals, volatile organic compounds and semi-volatile organic compounds. If the results of sampling indicate the landfill is a potential source area for contamination, appropriate steps would be taken to mitigate the potential for additional problems in the future. Mitigative measures could include, but not be limited to covering the landfill area with an impermeable synthetic material to reduce commingling of tailings leachate with landfilled materials.

A monitoring plan using standardized wetland assessment techniques for determining wetland functions and values would be performed to monitor impacts to wetlands and non-wetland waters of the U.S. during mining and to evaluate the success of re-establishing the functions and values at the wetlands mitigation sites.

Cultural Resource Monitoring Plan. Monitoring is recommended during any land disturbing activity (state, federal, and private) that has potential to adversely impact any unidentified sites for Alternatives II through V. The areas to be monitored are identified and discussed in Appendix K. Monitoring must be completed by a qualified archaeologist who meets the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716). All four tribes would be afforded an opportunity to monitor the activity. Should a site be discovered during project implementation, activity should stop until the site is formally recorded and evaluated for eligibility to the National Register of Historic Places. Evaluation should consider traditional tribal history. Should a site be determined to be eligible (in consultation with Tribes and formal review of the Montana State Historic Preservation Office-MTSHPO), consideration of effects of continuing with the project activities should be characterized (36 CFR 800.5). A determination of adverse effect should result in the design of mitigation measures. Mitigation measures will be described in a plan for site protection or data recovery. Mitigation plans require consultation with Tribes, and formal review by the MTSHPO and the Advisory Council on Historic Preservation, resulting in a Memorandum of Understanding.

Alternative IV -- Modified Rock Creek Project with Mitigations

The major modification distinguishing this alternative from Alternatives II and III is the location of the portals and mill site at the confluence of the east and west forks of Rock Creek, about 1.5 miles closer to the Clark Fork Valley than Alternatives II and III. This decreases the utility corridor length but increases adit length and the amount of waste rock produced (see Figure 2-24). Table 2-9 lists the significant issues pertinent to this project and indicates which of the following sections addresses mitigating measures for those issues. Chapter 4 contains a more detailed discussion of how the mitigating measures would reduce or eliminate environmental impacts.

TABLE 2-9
Alternative IV Modifications and Mitigations

Significant Issues	Categories						
	Mine Plan	Water Use & Management	Transpor-tation	Utilities	Employment	Reclamation	Monitoring & Mitiga-tion Plans
Surface & Ground Water Quality		x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x	x	x	x	x	x
Impoundment Stability							
Socioeconomics	x						
Old Growth Ecosystem	x						
Wetlands and Non-wetland Waters of the U.S.	x						x
Public Access/Traffic Safety			x				
Aesthetic Qualities	x					x	

Alternative IV includes applicable modifications, mitigations, and monitoring plans carried forward from Alternative III as summarized below. Descriptions are to be found in Alternative III for these items.

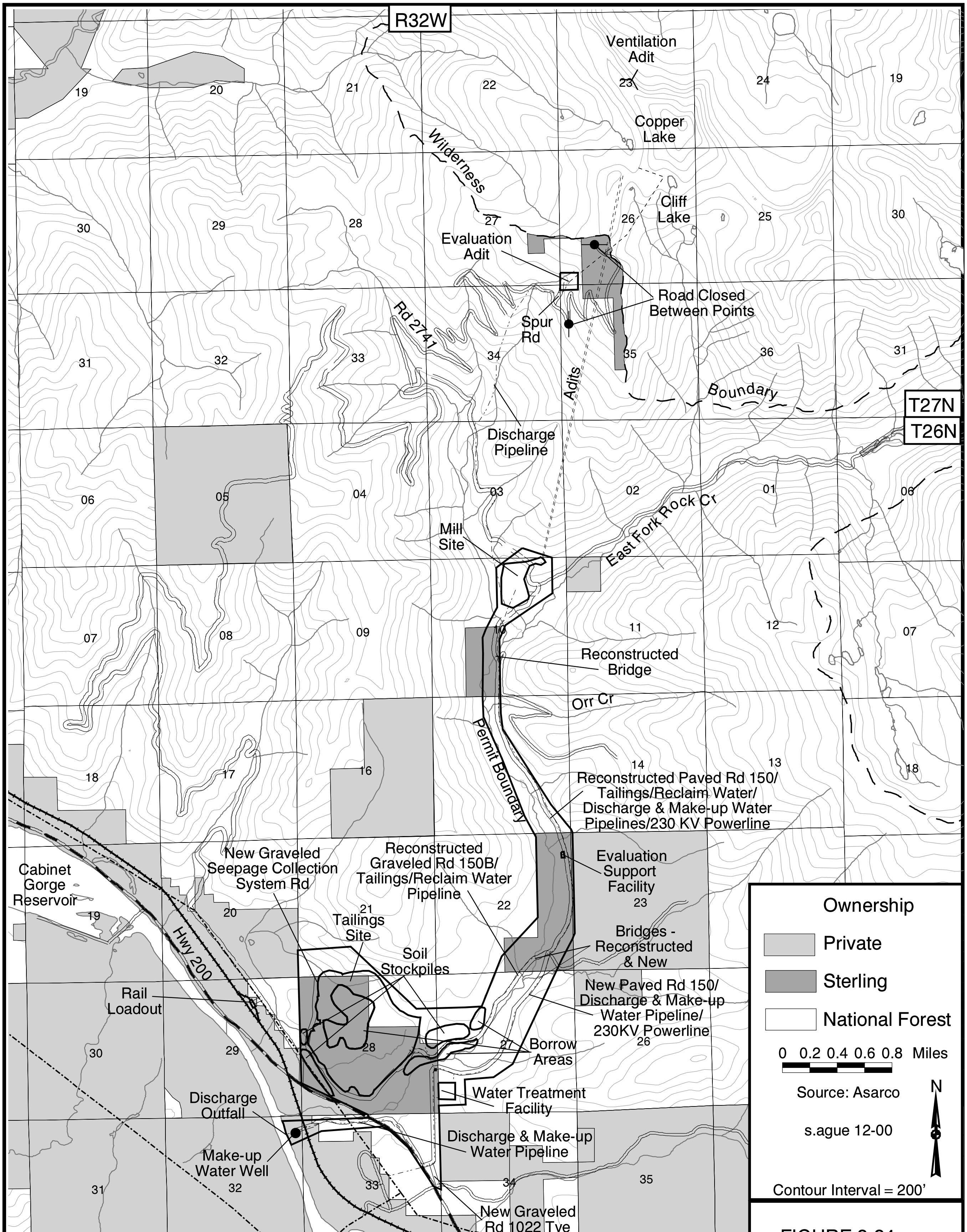


FIGURE 2-24
Alternative IV
Rock Creek Project

Modifications:

- Alternate impoundment design at the Rock Creek location
- Alternate rail loadout location near Miller Gulch
- Alternate location for wilderness air intake ventilation adit
- Combined utility and road corridor
- Relocation and reconstruction of the lower portion of FDR No. 150

Mitigations:

- Rock mechanics monitoring plan (subsidence control)
- Rock mechanics and hydrogeologic sampling, testing and monitoring program to include a rock geochemical testing program
- Visual and sound mitigations for the mill site and ventilation and evaluation adits
- Technical panel review of alternate impoundment design including feasibility of seepage reduction methods
- Starter dams constructed with mine waste rock
- More permeable areas within the tailings storage facility footprint sealed with excavated clays
- Pumpback wells at the impoundment
- A transportation management plan
- Visual mitigations for the utility corridor
- Revised grading and revegetation plans for the mill (modified for alternate location) and impoundment sites to mitigate visual impacts and development of a vegetation management plan
- Vegetation removal and deposition plan and vegetation management plan
- Deeper soil salvage (24 to 36 inches) and replacement depths (average 24 inches) to facilitate revegetation
- Long-term post-operational ground water monitoring and monitoring of streams and springs
- Treatment of adit drainage until drainage meets discharge standards without treatment

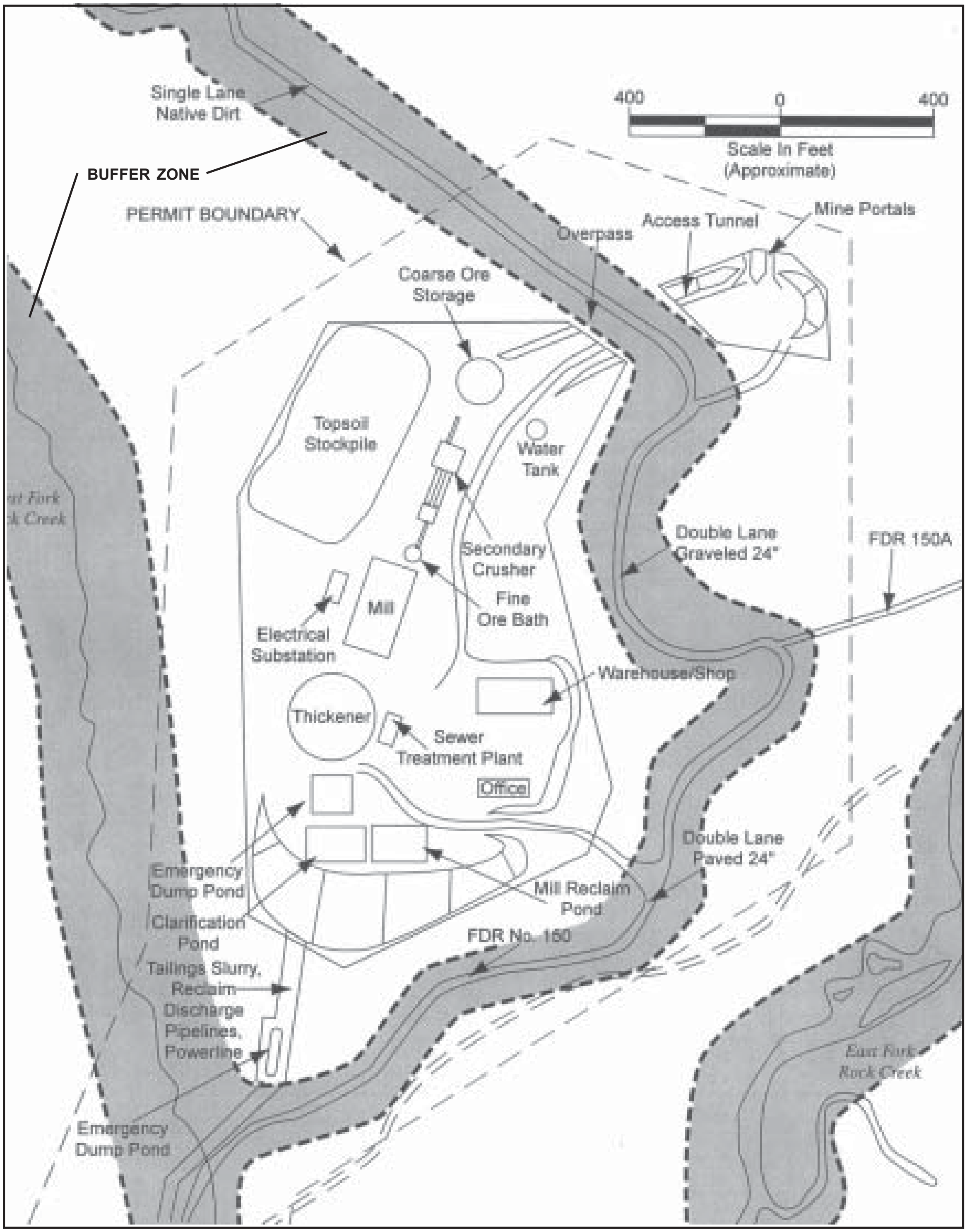
- Adits closed in accordance with a more detailed adit closure plan
- More detailed long-term reclamation monitoring plan than Alternative II
- More detailed aquatics/fisheries, wildlife, threatened and endangered species monitoring and mitigation plans than described under Alternative II, including a sediment source reduction plan outside the permit area
- A comprehensive, long-term water monitoring plan which includes monitoring lake levels, and water budget at Cliff and Copper lakes to be coordinated with subsidence control and monitoring plan and fisheries/aquatics monitoring plans
- An alert level and contingency/corrective action plan for each monitoring plan
- Cultural resources monitoring plan
- Maintenance of wastewater treatment system and possible long-term post-closure water treatment
- Revisions to the applicant's wetlands mitigation and monitoring plans
- All reasonable options to an air intake ventilation adit in the CMW would be pursued

Mine Plan

The alternative mine/mill site, as shown on figures 2-24 and 2-25, would be located above the 10-foot flood stage (about 100-year flood event). It would be sited on cut-and-fill pads located at the toe of the southwest facing ridge at the confluence. The layout would afford a reasonably compact mill site arrangement.

The portal location would be placed at elevation 3,040 feet and would be adjacent to the mill site (Figure 2-25). This location would place the portal 1,000 feet lower than Sterling's proposal. Each of the adits would be about 6,500 feet longer than those proposed by Sterling.

This results in an approximate 67 percent increase in waste rock production, from 600,000 tons to 1 million tons. A tabulation of differences between the alternative mine/mill site and the applicant's proposed location is provided in Table 2-10. The 1 million tons of waste rock would be used in part to construct the mill site pad, potentially raising the ground level at the mill site by a maximum of 50 feet. This elevated pad would increase mill site visibility from surrounding Forest Service roads and wilderness viewpoints that are located above the mill site. A maximum pad height of 50 feet and retention of a minimum 100-foot vegetative buffer around the pad would help limit mill site visibility from the portion of FDR No. 150 that surrounds the site. Additional rock excavated from the adits beyond that needed to construct the pad would be used for foundation material and construction of starter dams at the impoundment. There would be no separate waste rock dumps under this alternative.



SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-25
Alternative IV Confluence Mill Site Layout
Rock Creek Project

TABLE 2-10
Comparison of Mill Site Alternatives

Facility	Alternative II	Alternative IV	Difference for Alternative IV
Adit Elevation	4,100 ft.	3,040 ft.	Adit portal about 1,000 ft. lower
Adit Length	9,000 ft.	15,530 ft.	Each adit is 6,530 ft. longer
Adit Grade	+12.7%	+12%	0.7 % flatter
Waste Dump Tonnage	600,000 tons	1,000,000 tons	400,000 tons increase
Waste Dump Area	10 acres	included in mill site	10-acre decrease[1]
Mill Site Area	40 acres	47 acres	7-acre increase
Surface Conveyor Length	2,500 ft.	included in mill site	2,400 ft. decrease
Utility Corridor Length	5.7 mi.	5.2 mi.	0.5 mi. decrease
Road Upgrade Length[2]	19.9 mi.	17.64 mi.	2.26 mi. decrease

[1] Waste rock used for construction of mill site area.
[2] Includes mine and evaluation adit access road construction and upgrades as well as new road construction and road reconstruction.

Sterling would retain a minimum 100-foot vegetative buffer between FDR No. 150 and mine/mill facilities for visual screening except at the constructed overpass bridge for FDR No. 150 and at the mine adit access road (see Figure 2-25). Mill site surface disturbances would not occur within 300 feet of either fork of Rock Creek to provide a riparian corridor buffer. These buffers would help reduce sediment loading to Rock Creek and impacts to sensitive fish species and other aquatic life.

Surface Disturbance

A total of about 542 acres would be disturbed within the permit area under Alternative IV (see Table 2-2). The Forest Plan would be amended so that management allocations on 156 acres would be consistent with the intended use.

Ore Production Schedule

The mine development schedule has been lengthened to 4.5 years because of the additional time needed to develop the longer adit (see Table 2-11). Total project life could range from 33 to 37 years depending upon the actual amount of ore reserves and the ore extraction rate.

After limited ore production during early mine start-up there would be approximately 26 to 30 years of remaining production. This schedule could be affected by unforeseen delays related to permitting, design approvals, development or construction delays or accelerations, financial considerations, actual mining conditions and ore recoveries, and metal market conditions. An earliest estimated start date based on the EIS development schedule and possible timing of agency decisions would be no sooner than June 2002, however, actual project construction would be determined by Sterling based on market conditions and other business considerations.

TABLE 2-11
Estimated Project Development Schedule - Alternatives II through V

Number of Years			Project Development Stage
Alts. II & III	Alt. IV	Alt. V	
-1	1	1	Evaluation Adit
1.5	3	2[1]	Mine Development
1.5	1.5[2]	1.5[1,2]	Mine Development/Surface Facilities Construction
0.5	0.5	0.5	Start-up/Limited Production
26 - 30	26 - 30	26 - 30	Production[3]
2	2	2	Reclamation[4]
31.5 - 35.5	33 - 37	33 - 37	Total Project Life

Notes: 1 Waste rock would be hauled seasonally during mine development (years 2 through 6).
2 Includes construction of mill site, waste water treatment plant, and utilities corridor (Alts. IV and V) and paste plant Alt. V only.
3 The more conservative ore extraction rate of 65% would shorten production by approximately 3 to 4 years.
4 Reclamation of tailings impoundment for Alternatives II through IV may take more than 2 years because of time needed to dewater impoundments prior to final reclamation of the surface.

Water Use and Management

Water use and management would be substantially the same as in Alternatives II and III except that one unnamed intermittent stream would have to be routed through or around the mill site.

Transportation

Due to the relocation of the mill site, the new road construction and reconstruction would be shortened by approximately 2.3 miles. Mine and public traffic would share paved FDR No. 150 to the entrance of the mill site at which point Sterling would reconstruct FDR No. 150 to a 24-foot gravel road for a length of 0.36 miles to the intersection with the heavy equipment access road. The road would then taper to a single-lane and cross a newly constructed overpass above a gravel road providing general access between the mill and the mine adit (see figures 2-24 and 2-25). Public and mine traffic conflicts would be reduced by routing most of the mine adit traffic under FDR No. 150 except for heavy equipment.

Utilities

The utility corridor would be 5.2 miles long due to relocation of the mill site. The water pipelines would be buried and the tailings pipelines would be above ground as described for Alternative II. The mitigations for the utility corridor would be as described for Alternative III.

Employment

Mine development would take place over a longer period of time than was projected under previous alternatives and peak employment levels would be reduced. The increased length of the evaluation adit would require more time for its construction. A year-and-a-half would be devoted to this task with employment levels starting at 23 in the first quarter and increasing to 73 during the last two quarters.

Actual mine construction would begin within 18 months during which the entire workforce would consist of 73 Sterling employees, then 275 contract construction personnel would be brought onto the project for 18 months. As contract construction ended, the Sterling workforce would be expanded to 180 workers, from where it would continue to increase to 340 workers nearly 2 years later as the mine reached full production. Fluctuations in employment during mine construction and startup would be reduced under this alternative compared to Alternatives II or III. The contract construction peak employment of Sterling and contract workers would total 348, with the minimum employment following this peak being 180 mine workers.

Production operations would employ 340 people for a period of 26 to 30 years. At the end of production there would be a 2-year shutdown and reclamation period employing 35 workers.

Adit Closure

Adit closure plans for the air-intake ventilation and evaluation adits would be as described under Alternative III.

The service and conveyor adits would be plugged with reinforced concrete near the elevation of the orebody within the mine. This would prevent 1,500 feet of water pressure that would develop if adit seals or plugs were only placed at lower elevations in the adits. The adits would be closed at the portal with non-mineralized waste rock to prevent access. Drainage from the portal (inflow to the adits below the elevation of the plugs) would be treated until it met water quality standards without treatment at which time it would be allowed to infiltrate into the reclaimed mill pad and underlying alluvium. Monitoring data would be used to establish discharge requirements prior to the time of adit closure.

Reclamation

Reclamation objectives would remain the same as described for Alternative II.

Postmining Topography. Sterling would develop a design, subject to the Agencies' approval, to reshape faces of the confluence mill pad to more closely resemble the surrounding landscape. This design would incorporate small drainages, convex and concave forms, and varying slope gradients within swales that would repeat the surrounding landscape in form and shape. Pad faces would be graded concurrent with construction and revegetated immediately following pad completion, allowing the pad to blend with the surrounding landscape more quickly and reducing sedimentation to surface waters and impacts to sensitive fish species. The pad surface would be regraded and revegetated following mine closure. The overpass bridge would be removed and the trench of the underpass (of the general mine access road) refilled and regraded to approximate original contour. Interim revegetation around buildings and roads would stabilize the site during operations. Postmining topography of all other facilities would remain the same as described for Alternative III.

Soil Salvaging and Handling Plan. The soil salvage and handling plan would be the same as described for Alternative III. Soil salvage depths would be similar to those in Alternative III. Soil volumes would be slightly different due to the deeper soils available at the confluence site and less road construction and reconstruction. Soil stockpile locations for the mill site are shown on Figure 2-25. Soil would be salvaged and replaced in a two-lift method and direct haul of soil would be used whenever possible.

Revegetation. Sterling would develop a detailed final planting plan for the mill site. Final revegetation of pad faces would occur as soon as the pad was completed. It would be seeded with grasses and forbs and planted with containerized shrubs and trees. Plantings would mimic natural patterns of vegetation. All other aspects of the planting plans would be as described in Alternative III.

During mine life, Sterling would also reclaim all cut-and-fill slopes along the access roads, and the adit portal slopes and waste rock dump slopes as slopes reach final grade to maximize native plant establishment and minimize erosion, weed invasion and visual impacts during mine life. Interim reclamation plans would be developed with agency reclamation specialists to reduce slopes if practicable to approximate postmine contours wherever possible.

Slopes reclaimed during operations would be revegetated with the permanent seed mix and planted as per the approved plan. This aggressive reclamation program is designed to increase native plant establishment, increase sediment and erosion control, limit noxious weed invasion, and reduce visual impacts during mine life.

At the end of mine life agency reclamation personnel would review the reclamation success on the slopes and decide if the successful portions with up to 20-30 years of vegetation growth could be left in the final reclamation plan. Portions with unsuccessful reclamation would be recontoured as per the reclamation plan and soiled or rocked accordingly.

Monitoring and Mitigation Plans

Monitoring and mitigation plans for Alternative IV would remain the same as described under Alternative III with the following two exceptions.

Threatened and Endangered Species Mitigation Plan. Nearly all aspects of the Threatened and Endangered Species Mitigation Plan proposed for Alternative III would be the same. However, the relocation of the mill site and the shorter transportation corridor would reduce the impacted acres; Sterling would have to acquire 2,536 replacement or conservation easement acres as part of the mitigation.

Wetlands Mitigation Plan. Alternative IV would impact 6.2 acres of wetlands and 0.4 acres of non-wetland waters of the U.S. (see Table 2-6). Only 10.5 acres of wetlands mitigation sites proposed by the applicant would still be available for use. Other locations within the riparian areas along Rock Creek and within the proposed permit area might have the necessary wetland hydrologic characteristics to replace the access road mitigation site acres. Sterling might be required to identify additional mitigation sites to comply with its 404(b)(1) permit. Other components of the wetlands mitigation plan would be the same as for Alternative III.

Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)

The major modifications distinguishing this alternative from Alternative IV are the deposition of tailings as a paste, an alternate water treatment system, an enclosed rail loadout facility, and relocation of the evaluation adit support facilities (see Figure 2-26). There is also a modification to the mill site and mine portal to improve mine to mill ore transport efficiency (see Figure 2-27). Table 2-12 lists the significant issues pertinent to this project and indicates which of the following sections addresses mitigating measures for those issues. Chapter 4 contains a more detailed discussion of how the mitigating measures would reduce or eliminate environmental impacts.

TABLE 2-12
Alternative V Modifications and Mitigations

Significant Issues	Categories							
	Mine Plan & Ore Processing	Tailings Disposal	Water Use & Management	Transportation	Utilities	Employment	Reclamation	Monitoring & Mitigation Plans
Surface & Ground Water Quality		x	x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x	x	x	x		x	x
Impoundment/Paste Facility Stability		x						
Socioeconomics	x							
Old Growth Ecosystem	x							
Wetlands and Non-wetland Waters of the U.S.	x	x						x
Public Access/Traffic Safety	x			x				
Aesthetic Qualities	x	x			x		x	

In addition, to the major modification mentioned above, Alternative V includes the following applicable modifications, mitigations, and monitoring plans from Alternatives III and/or IV as well as components from Alternative II. These items are listed below. The alternative shown in parentheses at the end of each bullet statement indicates the source of the modification or mitigation. A description of these items has been incorporated into the Alternative V description to provide the reader with a full description of this alternative and to reduce the amount of searching through the previous alternatives to determine what exactly was carried forward.

Modifications:

- Alternate mill and mine portal location at confluence of east and west forks of Rock Creek (Alternative IV) and subsequently shorter combined access road and utility corridor

- Alternate rail loadout location near Miller Gulch (Alternative III)

- Alternate location for wilderness air-intake adit (Alternative III)

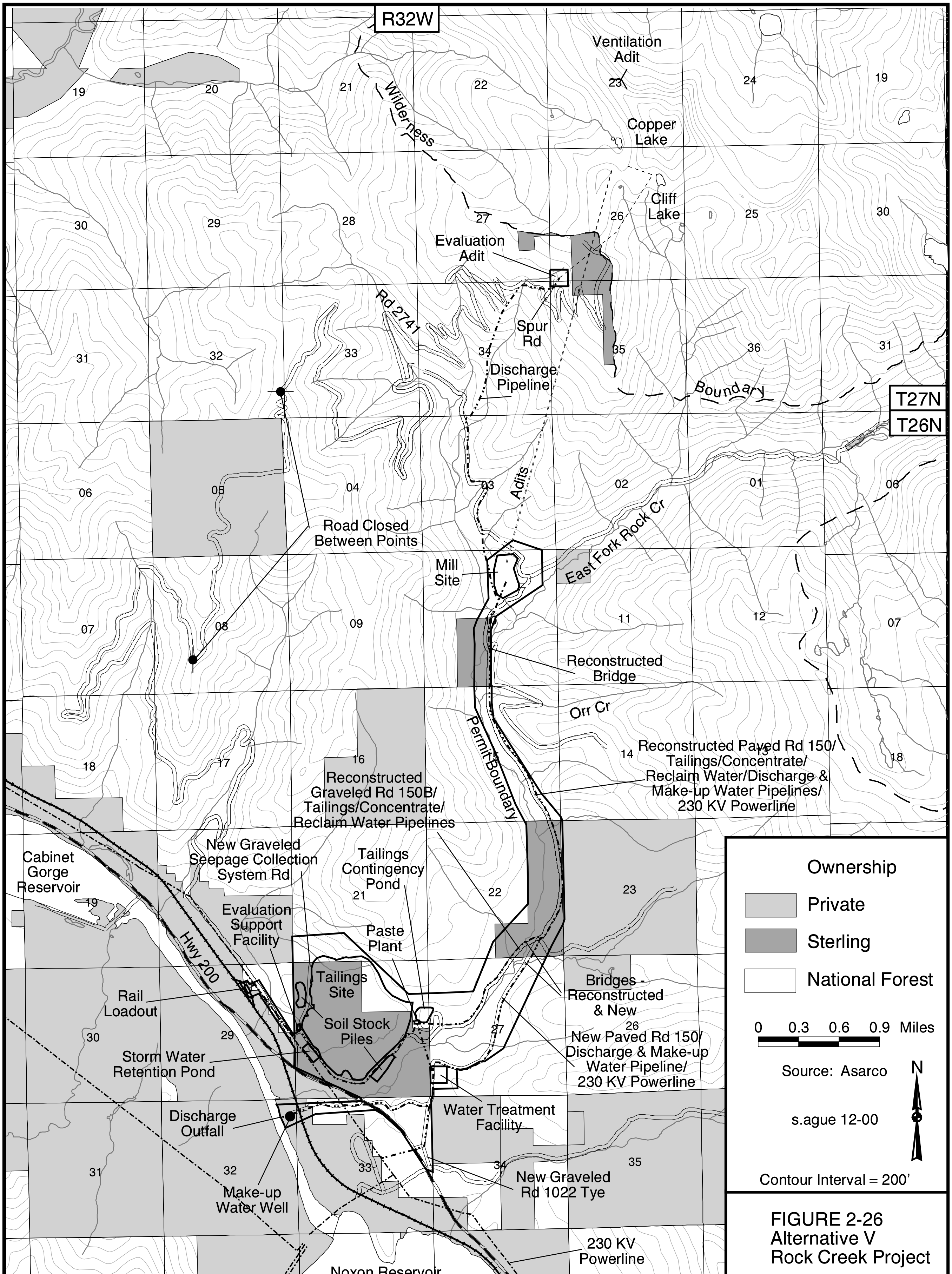
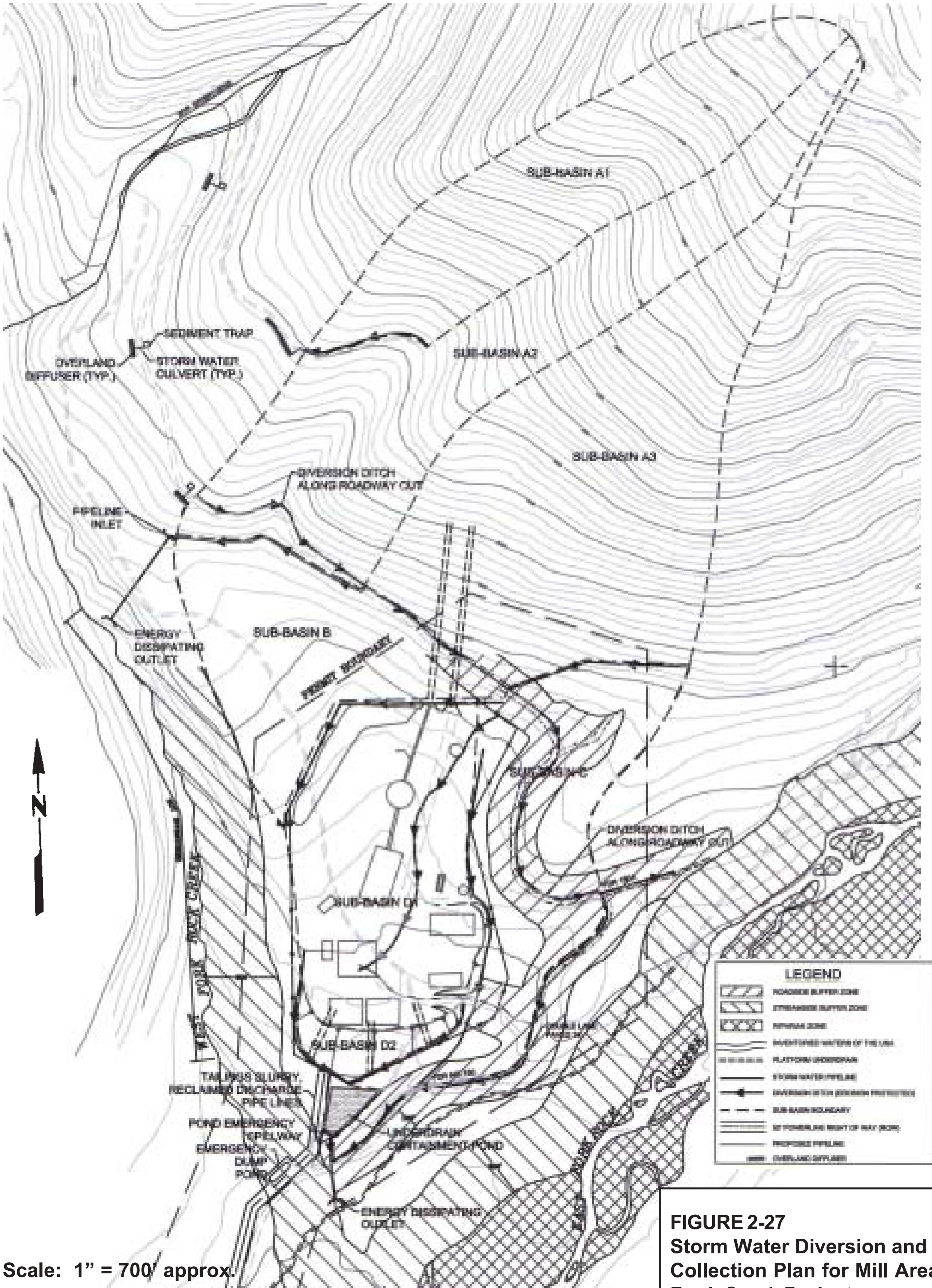


FIGURE 2-26
Alternative V
Rock Creek Project



Scale: 1" = 700' approx.

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-27
Storm Water Diversion and Collection Plan for Mill Area Rock Creek Project

Mitigations:

- Rock mechanics monitoring plan (subsidence control) (Alternative III)
- Rock mechanics and hydrogeologic sampling, testing and monitoring program to include rock geochemical testing program (Alternative III)
- Visual and sound mitigations for the mill site (Alternatives III and IV), and ventilation and evaluation adits (Alternative III)
- Technical panel review of final tailings storage facility design (paste facility under Alternative V) (Alternatives III and IV)
- Starter dams constructed with mine waste rock toe buttresses (Alternative III)
- More permeable areas within tailings storage facility sealed with excavated clays (Alternative III)
- A transportation management plan (Alternative III)
- Visual mitigations for the utility corridor and tailings impoundment site (paste facility site under Alternative V) (Alternative III)
- Revised grading and revegetation plans for the mill site to mitigate visual impacts (Alternative IV) and development of a vegetation management plan (Alternative III)
- Deeper soil salvage (24 to 36 inches) and replacement depths (average of 24 inches) to facilitate revegetation (Alternative III)
- 300-foot streamside buffer zone around mill (Alternative IV)
- 100-foot visual buffer between FDR No. 150 and mill site (Alternative IV)
- More detailed long-term reclamation monitoring plan than Alternative II (Alternative III)
- More detailed aquatics/fisheries, wildlife, threatened and endangered species monitoring and mitigation plans than under Alternative II (see Appendix K), including a sediment source reduction plan (see Alternative III) (see Erosion and Sediment Control)
- A comprehensive, long-term water monitoring plan which includes monitoring lake levels at Cliff and Copper lakes to be coordinated with subsidence control and fisheries/aquatics monitoring plans (Alternative III)
- An alert level and contingency/corrective action plan for each monitoring plan (Alternative III)
- Maintenance of the wastewater treatment system and possible long-term post-closure waste water treatment (Alternative III)

- Revisions to the applicant's wetlands mitigation and monitoring plans (Alternative III)
- All reasonable options to an air intake ventilation adit in the CMW would be pursued (Alternative III)
- Cultural monitoring during surface disturbing activities (Alternative III)

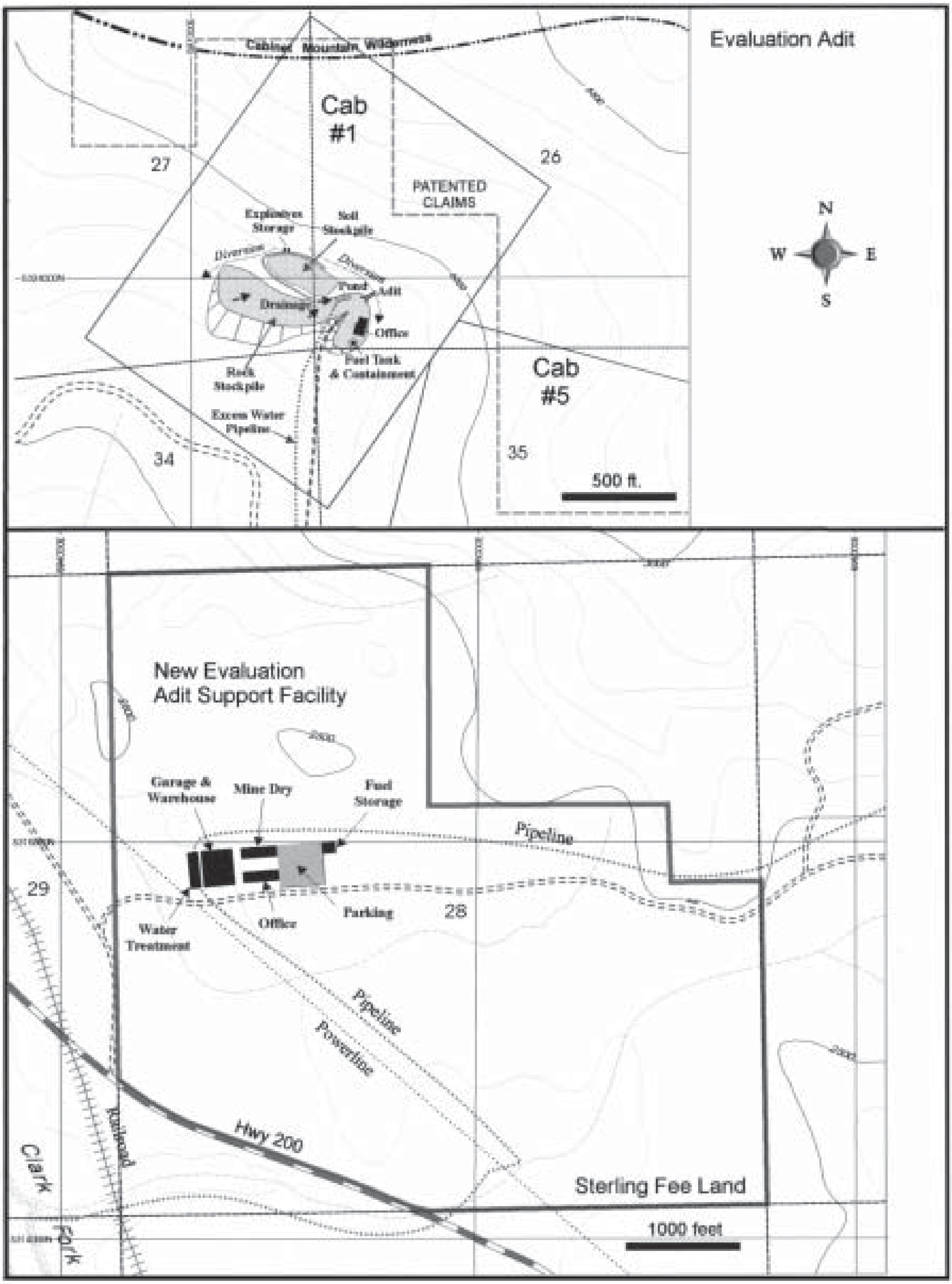
Evaluation Adit

The proposed evaluation adit would be driven prior to other work on the Rock Creek Project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as an additional ventilation (exhaust) opening and as a secondary escapeway, when the two adits met. Conventional mining methods would be employed during the 1-year evaluation adit construction period. Existing roads would provide access and an estimated 8.3 acres would be disturbed. While most of the pertinent information about the evaluation adit is included below, more details on the evaluation adit can be found in the Rock Creek Evaluation Adit License Application (ASARCO Incorporated 1992).

The adit portal would be located at about 5,755 feet elevation. About 59,000 tons of waste rock and 119,000 tons of ore would be excavated from the proposed adit (18 feet high by 18 feet wide with an estimated length of 6,592 feet at a decline of 10 percent). Unmineralized or barren waste rock would be end-dumped near the portal to form a flat-topped pile sloping downhill to its angle of repose. Mineralized material would be placed in a stockpile near the portal for later processing when the mill was in operation. A lined storm water containment pond would also be constructed on the portal pad.

Several facilities are proposed to be constructed for the evaluation adit (Figure 2-28). A few of these facilities would be located at the evaluation adit portal site. A 40-foot by 80-foot temporary steel shop building on a concrete slab would be constructed on top of the initial waste material removed from the adit. This building would provide warehouse space, indoor work space, a lunchroom, and lavatories. Two propane-fired generators (545 kW and 735 kW) would be located in a lean-to attached to this building to provide power during adit construction rather than the diesel generators proposed under Alternatives II-IV. An above-ground propane tank would be located near the shop building at the adit site. All exterior lights would be shielded or baffled from viewpoints in the Clark Fork Valley. Upon completion of the evaluation adit, all facilities would be either removed from the permit area or moved to the mill site for use during mining.

Excess water from the evaluation adit and the storm water containment pond overflow would be pumped through a temporary 6-inch polyethylene pipeline to a temporary wastewater treatment system at the lower support facilities site prior to discharge. This system would consist of a portable reverse osmosis unit and a pilot anoxic biotreatment system. (See the Water Use and Management section below for more detail on these systems.) Discharges must comply with MPDES limits. Sterling would install the portion of temporary mine water discharge pipeline between the evaluation adit and the support facilities site with a cable and winch instead of dragging it through the woods with a tractor. This would minimize vegetation clearing and erosion on the steep hillside below the evaluation adit. This pipe would be removed in a similar fashion when the mine reached the evaluation adit or through the reclamation of the evaluation adit whichever came first; the evaluation adit water would then be routed through the mine water drainage and collection system.



Source: ASARCO, Incorporated 1999.

FIGURE 2-28
Evaluation Adit and Support Facilities
Rock Creek Project

Additional support facilities would be located within the paste facility footprint (see Figure 2-28) rather than in Section 22 as proposed under Alternatives II-IV. These include: an office situated in a 12-foot by 60-foot trailer or other similar structure; a changehouse/dry set up in another trailer; a garage and warehouse located in a pre-engineered steel building on a concrete slab; a graded, graveled employee parking lot; and a soil stockpile. A 500-gallon above-ground gasoline storage tank in a lined containment structure would be located near the garage and warehouse. The support facilities site would be supplied with electrical power from a local distribution line.

Extensive data collection, sampling and monitoring would be required during the construction of the evaluation adit. Rock geochemical characterization, monitoring and mitigations are discussed in the Acid Rock Drainage and Metals Leaching Plan in Appendix K. This plan includes provisions for waste rock handling during adit construction as well as contingency needs should premature project closure occur before mine construction and development begins. The evaluation adit data collected and evaluated through this plan and rock mechanics and hydrological data collected through the Evaluation Adit Data Evaluation Plan (EADEP) would be used to modify mine designs and operations to keep impacts at or below the levels disclosed in Chapter 4.

Mine Plan

Mine and Mill Operations. The mine plan would remain the same as described for Alternatives II through IV. The entire mill complex, including the mine portals, surface conveyor, SAG mill, office building, shop, sewage treatment plant and warehouse, would be located at the confluence of the east and west forks of Rock Creek as described for Alternative IV. However, the mine portal would be moved to the west side of FDR No. 150 just north of the coarse ore storage (see Figure 2-27). This aligns the adits with the mill facilities and eliminates two transfer points on the ore conveyor belt system. There would be no mine facilities on the east side of FDR No. 150 at the confluence mill site other than storm water control features. This alternative mine/mill site, as shown on Figure 2-27, would be located above the 10-foot flood stage (about 100-year flood event) with a minimum 300-foot buffer between the mill site and the east and west forks of Rock Creek to create a riparian buffer zone. It would be sited on cut-and-fill pads located at the toe of the southwest facing ridge at the confluence. The layout would afford a reasonably compact mill site arrangement.

Mill Site and Mine Adit Construction. The portal location would be placed at an elevation of 3,040 feet and would be within the mill site. Each of the access adits would be about 15,530 feet long and about 1 million tons of waste rock would be produced during their construction. The waste rock would be used in part to construct the mill site pad, potentially raising the ground level at the mill site by a maximum of 50 feet. This elevated pad would increase mill site visibility from surrounding Forest Service roads and wilderness viewpoints that are located above the mill site. A maximum pad height of 50 feet and retention of a minimum 100-foot vegetative buffer around the pad would help limit mill site visibility from the portion of FDR No. 150 that surrounds the site. Additional rock excavated from the adits beyond that needed to construct the pad would be used for foundation material at the tailings paste facility. Hauling of waste rock from the adits to the tailings paste facility site would only occur between August 1 and March 31 as a mitigation to impacts on harlequin ducks. There would be no separate waste rock dumps under this alternative. Directional grouting prior to blasting would be used during adit construction to minimize seepage into the adits during construction and mine operation. Monitoring of ground water and rock mechanics and geochemical rock characterization would continue during adit and mine construction as described in Appendix K.

Mill Site Mitigations. Aesthetic impacts of the mill and mine-related facilities would be minimized because Sterling would be required to implement the following mitigations:

- plant or retain a vegetative buffer of sufficient width between FDR No. 150 and mill site (minimum 100-foot buffer), the waste water treatment facility, and the substation in the lower Rock Creek drainage for visual screening;
- treat and/or paint permanent (life-of-mine) structures within the project area to visually blend with the surrounding landscape;
- shield or baffle exterior lights from viewpoints in the Clark Fork Valley;
- operate all surface and mill equipment so that sound levels do not exceed 55 dBA measured 250 feet from the mill;
- replace above-ground vehicle back-up beepers with discriminating back-up alarms that sense movement behind a vehicle if allowed by OSHA.

Mine Ventilation and Wilderness Air-Intake Adit. Electric ventilation fans would initially use the conveyor adit for intake and the service adit for exhaust. However, Sterling would use the evaluation adit for air exhaust ventilation during the operation phase once the mine intercepted the evaluation adit and might possibly require a separate air-intake ventilation adit in the wilderness towards the end of mine life. Intake and exhaust ventilation fans in the exploration and mine adits would be adjusted so that they generate less than 82 dBA measured 50 feet downwind from the portal entrances.

If in the future, monitoring showed a need to provide additional ventilation for mine personnel health and safety as required by the Mine Safety and Health Administration (MSHA) rules and regulations, it may be necessary to drive an adit to the surface in the wilderness to provide an additional air intake and a secondary escapeway from the mine about year 20 of mine operation. The air-intake ventilation adit would be driven from the underground workings; there would be no need for the creation of a waste rock dump at the adit portal in the wilderness. Fans would be located no closer than 200 feet underground from the wilderness adit opening. A process would be developed to ensure locating an air-intake ventilation adit in the CMW would be the last choice among potential ventilation options. Other options could include an upgrade of the existing ventilation system and closure of portions of the exhausted underground workings. If Sterling and the agencies determine that other methods of expanding ventilation capacities are reasonable Sterling would implement other ventilation techniques prior to being permitted to construct the wilderness adit/portal. If it was deemed necessary to construct the air-intake ventilation adit in the CMW, Sterling would conduct a detailed study verified by a site visit with the agencies prior to excavation to evaluate variations in topography and rock formations. Other site-selection criteria would consider possible post-closure use of the adit for bat habitat. The agencies would evaluate the compatibility of this post-mine use with restoration of premining appearance and configuration to address visual impacts. For purposes of analysis in this EIS, the agencies have assumed that the air-intake ventilation adit would be located about 400 feet north of the west ridge of Saint Paul Peak and would disturb about 800 square feet. The wilderness air-intake ventilation adit would be located so as to minimize visual impacts and reduce noise impacts to 45 dBA (measured 50 feet from the ventilation portal). If necessary to achieve this level, specially designed low-noise fan blades or active noise-suppression equipment would be used. Sterling would contact the Forest Service prior to construction for approval of final siting and construction methods.

Mine Plan. The room-and-pillar system of mining is used for most flat-lying or nearly flat-lying ore deposits where the ground is hard and firm, and where artificial means of support would be too costly. Room-and-pillar is one of four common types of open stope (underground excavation) methods.

In room-and-pillar mining, some ore is left unmined to give support to the mine roof. The slot-pillar system is similar to room-and-pillar. Rather than a regular pattern of rooms and square pillars, a slot pillar is longer in one direction, creating a system of rectangular pillars and rooms. This design is used when more ground support is needed. Generally, a regular pattern of pillars is more efficient than an irregular one, and the size and spacing of support pillars varies depending on local ground conditions (Earll et al. 1976).

Sterling proposes to use a combination of room-and-pillar and slot-pillar designs[10]. The majority of the mine layout would use a regular pattern of rooms and pillars. A design layout similar to the Troy Mine is proposed. The determination of when to use a regular pattern versus a slot pillar approach would be made after examining local ground conditions and rock mechanics data.

Sterling would be required to provide an updated preliminary mine design for agency review and approval prior to exploration and mine start-up. The agencies would conduct a second review of the mine design to determine its suitability for actual conditions during mine adit construction. Specifics of this review would focus on general design approach, design criteria and methodology, rock mechanics test data from the Rock Creek deposit,[11] proposed room-and-pillar sizing and layout, identification of zones of rock instability and potential subsidence, and mitigations for these areas. Given the expected changes in planning any underground mine development, Sterling would submit updated detailed mine plans for agency review prior to entering areas where mining could have deleterious environmental impacts if adequate precautions were not taken. This would ensure development was meeting the environmental objectives and intentions of the original design. Approval of the mine plan would be contingent on demonstrating that the risk to Copper and Cliff lakes and the potential for subsidence would be minimized, based on hydrogeologic and applicable engineering analyses. Secondary pillar recovery would not be allowed.

The average depth of the ore body is 900 feet below the surface except where the ore approaches the outcrop interfaces. In order to protect against surface subsidence, hydrofracturing and leakage to the surface, Sterling would be required to leave a minimum of 450 feet of overburden over the mine workings particularly near the ore outcrops located in the northeast and southeast portions of the orebody and in Copper Gulch. Additionally, Sterling would not be allowed to mine closer than 1,000 feet from the outcrops and would not cross the Moran Fault (MT DEQ 2001). These limits would be modified based on site-specific rock mechanics and hydraulic information gathered as a result of the ongoing mining operation and the required Rock Mechanics Monitoring Plan.

A buffer of 1,000 feet around Cliff Lake, ore outcrop zones, the Copper Lake fault, and the Moran Fault would remain unmined until the hydrogeology of this area is better characterized through the monitoring process. In the Copper Lake Fault area where ore thicknesses exceed 100 feet, Sterling proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential

[10] The pillars would be 45 feet square and drives and cross-cuts 45 feet wide. Ore recovery is projected at 65-75 percent. As ore thickness increased and/or overburden decreased more ground support may be necessary. Again, using a design from the Troy Mine, Sterling proposes to use a slot-pillar approach. The pillars would be 30 feet wide while the drives would be 50 feet wide. The overall length of the slot pillar would vary but could be on the order of several hundred feet long. Ore recovered using this approach is reduced (10 percent at Troy Mine), however ground support is improved.

[11] Rock mechanics data would initially be obtained during construction of the evaluation adit as outlined in the Rock Mechanics Monitoring Plan and the Evaluation Adit Data Evaluation plan described briefly in this document and in more detail in Appendix K of the final EIS.

poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

In areas where the proposed ore extraction thickness exceeded the capacity of designed pillars, Sterling proposes to use a horizontal pillar to facilitate extraction over the entire ore height. A horizontal pillar is a section of unmined material left in place between two rooms stacked one on top of another (see Figure 2-9). Using a design from the Troy Mine, Sterling expects to use this approach when ore thicknesses exceed 75 feet.[12] Although ore recovery would be reduced to 52 percent from 75 percent using this design, it would allow for ore extraction over the entire ore column.

Conventional drilling, blasting, rock bolting, and mucking methods would be used underground. Broken ore would be processed by an underground crusher and then transported to the surface via conveyor belt for further processing. A surface conveyor belt would transport ore from the adit portal to the mill. A maximum of 2,500 cubic yards of ore mined during the construction period would be stockpiled at the mill site for treatment following construction of mill facilities. Waste rock generated underground during the production period would be stored in mined-out areas.

Seasonal storage of mine water within underground mine workings is proposed to regulate outflow through the water treatment system. By year 27, a 207.7-million-gallon reservoir would be established in worked out portions of the mine to handle maximum water storage requirements. This would equate to a maximum storage capacity of about 64 acres with water 10 feet deep. The area and volume required for storage would be increased throughout the mine life on an as-needed basis by modifying the mining method to create the storage areas. The ore in the storage areas would be mined using conventional methods except that barrier pillars would be left in place along either side of the storage area.

Rock geochemical characterization, monitoring and mitigations, for determining suitability of waste rock to be used for mill pad construction, road gravel, and paste facility toe buttresses and finger drains, are discussed in the Acid Rock Drainage and Metals Leaching Plan in Appendix K. This plan includes provisions for waste rock handling during operation as well as contingency needs should premature project closure occur. The evaluation adit geochemical data collected and evaluated through this plan and rock mechanics and hydrological data collected through the EADEP would be used to modify mine designs and operations to keep impacts at or below the levels disclosed in Chapter 4. The facilities, designs and plans must be approved prior to mine construction and operation.

Reduced-emission diesel engines would be used in place of standard diesel engines underground. Electric underground ore trucks would also be used. These modifications would reduce concentrations of noxious gases released to the atmosphere and underground workings.

Surface Disturbance

A total of about 482 acres would be disturbed within the permit area of 1560 acres under Alternative V (see Table 2-2). Land encompassed by the proposed permit boundary is 48 percent privately held and 52 percent NFS lands. The Forest Plan would be amended so that management allocations on 147 acres would be consistent with the intended use.

---

[12] Vertical pillars would be 30 feet wide, rooms 50 feet wide, and the horizontal pillar 40 feet thick. In this manner a 200-foot thick ore horizon could be mined with two 80-foot-tall rooms with the intervening 40-foot horizontal pillar.

Ore Production Schedule

Ore production scheduling would be similar to that described for Alternative IV (see Table 2-11). Sterling would develop an underground mine that would produce 10,000 tons of ore per day, or 3.5 million tons per year. Ore reserves are estimated to range between 136 and 144 million tons averaging 1.65 troy ounces per ton of silver and 0.68 percent copper. About 65 percent of the ore body would likely be mined, with about 35 percent remaining as pillars and other structural support. Actual underground conditions would govern the amount of ore removed.

Based on these figures, Sterling would mine and mill between 88 million tons and 108 million tons of ore giving the mine an anticipated production life of 25 to 30 years and a total project life of 33 to 37 years depending upon the actual amount of ore reserves and the ore extraction rate (see Table 2-11). Based on milling efficiencies at the Troy Mine, Sterling anticipates a milling efficiency of 85 percent. That is, about 85 percent of the copper minerals and silver in the mined ore would report to the concentrate, while 15 percent would remain in the tailings.

Ore Processing and Shipment

The ore-processing facility or mill would remain generally the same as is described for the proposed action, Alternative II, but would be located at the confluence of the east and west forks of Rock Creek as described for Alternative IV. The primary difference from the other action alternatives is that there would be no tailings thickener facility at the mill site due to the change in tailings disposal (see Paste Deposition of Tailings below). The thickener would not be necessary as the tailings would be dewatered at the paste production plant adjacent to the tailings paste facility. However, the emergency dump pond and the storm water pond would be enlarged to provide additional water storage (see Figure 2-27).

Sterling modified the milling operation to reduce particulate emissions under Alternative V. The surface dry milling operation or secondary crushing would be replaced with a semi-autogeneous (SAG) mill, a fully wet milling operation. Concentrate would be sent from the mill to the rail loadout facility as a slurry in a 3-inch HDPE-lined steel pipe with leak detection sensors and buried in the same corridor as the tailings and water pipelines. The rail-loadout process including concentrate dewatering, drying, and storage and railcar loading would take place within an enclosed building. Covered railcars would eliminate the use of a tackifier that would have been needed to minimize dust generation during transport to the smelter. Approximately 13 railcars of concentrate per week would be removed from the site. Reclaimed concentrate water would be piped to the paste plant and then to the mill for reuse.

Paste Deposition of Tailings

Facility Design. The conceptual tailings paste facility design has undergone an engineering review for feasibility and stability (Klohn-Crippen 1998). The tailings paste facility design would be finalized as additional site information was obtained from the final design investigation process. Technical review of the final design would be made by a technical review panel established by the agencies. Review would encompass the technical aspects of design including the short- and long-term stability of the tailings storage facility. If supplemental rock and tailings characterization data and geochemical testing showed a potential for acid generation not presently anticipated, the review would also include consideration of some form of a seepage-inhibiting layer or liner beneath the impoundment. The technical review panel would assist in the development of the QA/QC protocols. The panel would ensure that any environmental impacts associated with final design remained within the scope of those impacts identified in the final EIS. If the final design generated additional impacts and they could not be mitigated to remain within this scope, then further MEPA/NEPA documentation would be required. The agencies would have to review and approve the final design prior to construction.

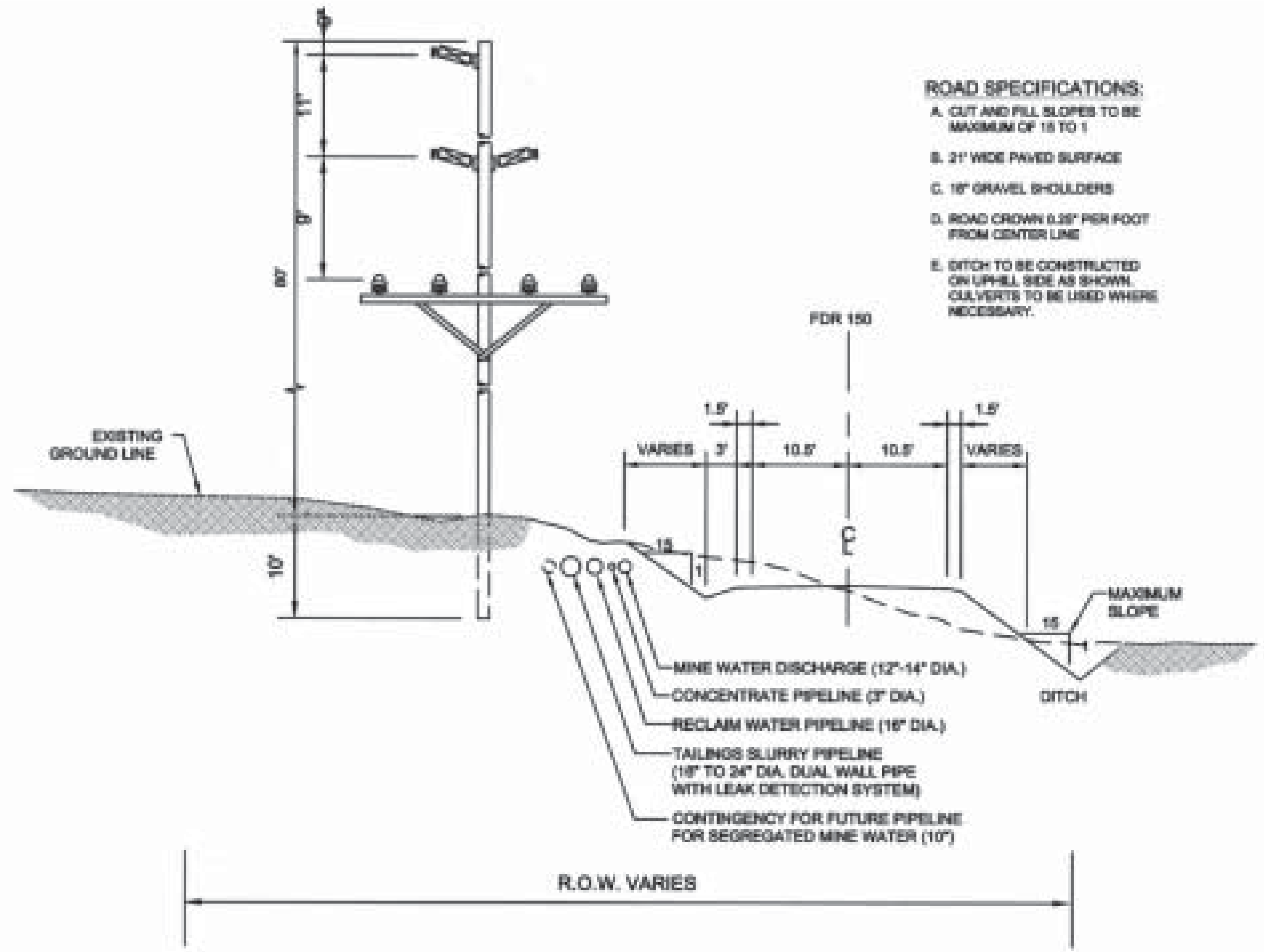
Tailings Transport. Tailings would be transported 4.1 miles from the mill to the paste plant as a slurry (30 percent tailings, 70 percent water) in a 16- to 24-inch, urethane-lined, steel pipeline (a double-walled pipeline) with leakage detection devices. This pipeline, the 16-inch return process water line (which would also be used as the make-up water line), and the concentrate pipeline would be buried at least 24 inches deep (see Figure 2-29). Burying the pipelines will provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the paste plant. The pipelines would be visible at the three above ground crossings of Rock Creek, West Fork of Rock Creek, and Engle Creek. All lines would be encased in a larger steel pipe at creek crossings adjacent to or near bridge crossings to guard against the unlikely event of a leak or rupture.

Paste Production. In general, the tailings would be delivered to the paste plant and dewatered to make a paste with a known proportion of water (approximately 20 percent by weight). This paste would be applied to the ground surface after sediment and erosion control features are in place and soil has been salvaged, and the foundation has been prepared as described under Alternatives III and IV including the use of excavated clays to seal permeable areas of footprints.

The paste plant building, approximately 80-feet by 80-feet by 110-feet high, would be located on the hillside adjacent to the tailings paste facility site. The building would be built into the hillside and painted to help reduce its visual impact. Trees and vegetation surrounding the paste plant would be retained or planted to help visually blend the plant site with adjacent hillsides. Sterling would conduct a site study verified by a visit with the Agencies prior to final siting of the plant and access road to select a location that would reduce plant visibility and avoid harlequin duck habitat to the extent possible.

The paste plant would be designed to receive, dewater, mix, and pump 10,000 tons of tailings per day, 365 days per year. The paste process schematic is shown in figures 2-30 and 2-31. The tailings slurry would be deposited into a tailings surge tank and then fed into two cyclone/separators. The cyclone underflow, composed of the coarser tailings, would be discharged into a coarse tails storage tank (25-foot-diameter by 50-foot-high) and could be discharged at a rate of 50 tons per hour (tph). The overflow, composed of primarily finer tailings, would be fed through a distributor box into one or more of the four 32-foot-diameter by 60-foot-high paste dewatering tanks. The tailings would be discharged from each tank at a rate of 67 tph. Maximum discharge rate could reach 90 tph to allow for maintenance of one tank while continuing paste production in the other three tanks.

Process water for paste production would come from the water discharged from the paste dewatering tanks. Process water would be stored in a 30,000-gallon tank; excess water would be pumped back to the mill for reuse or discharged from the mill to the waste water treatment facility for disposal.

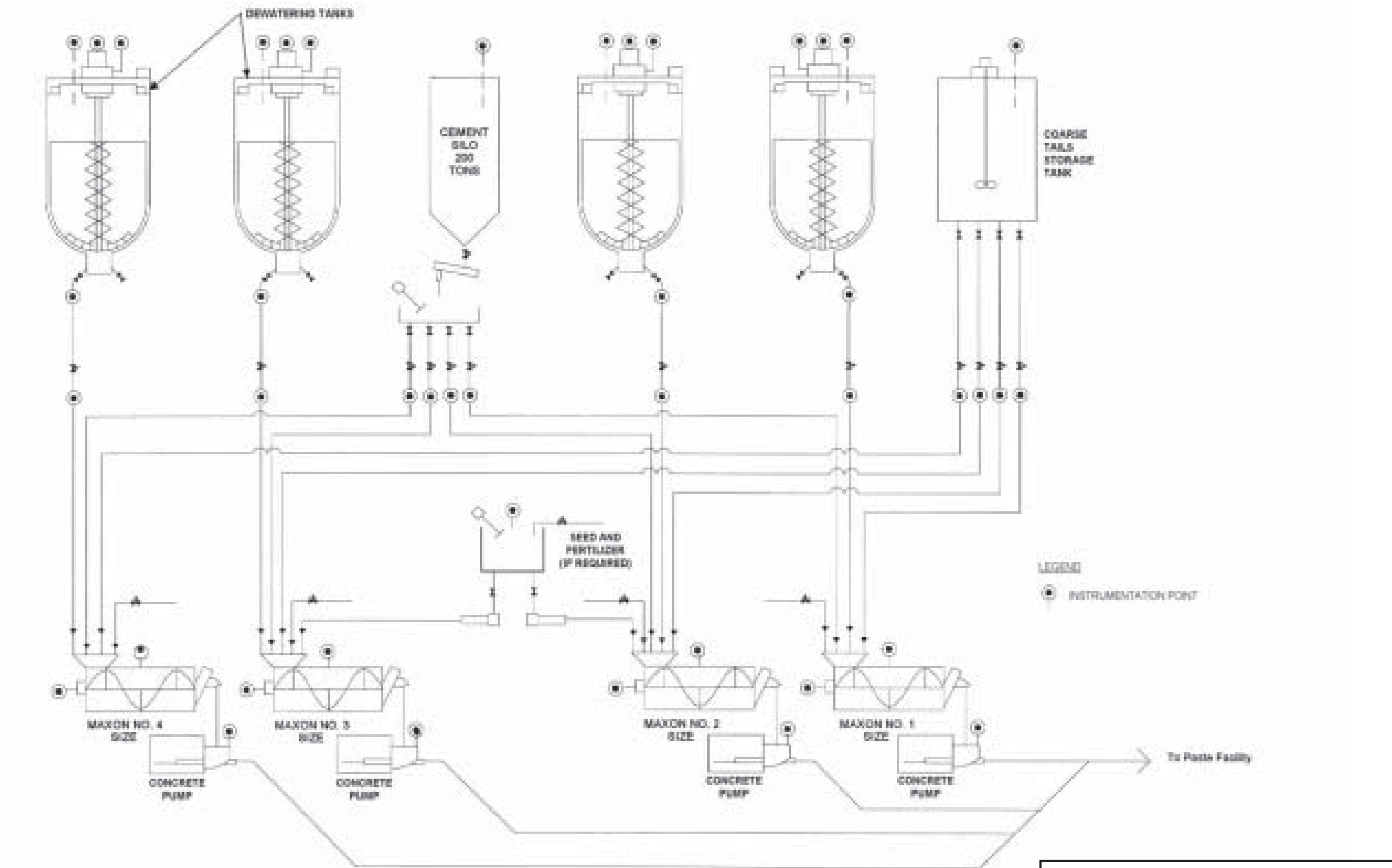


NOTE:

1. All Pipelines would be installed with leak detection systems.

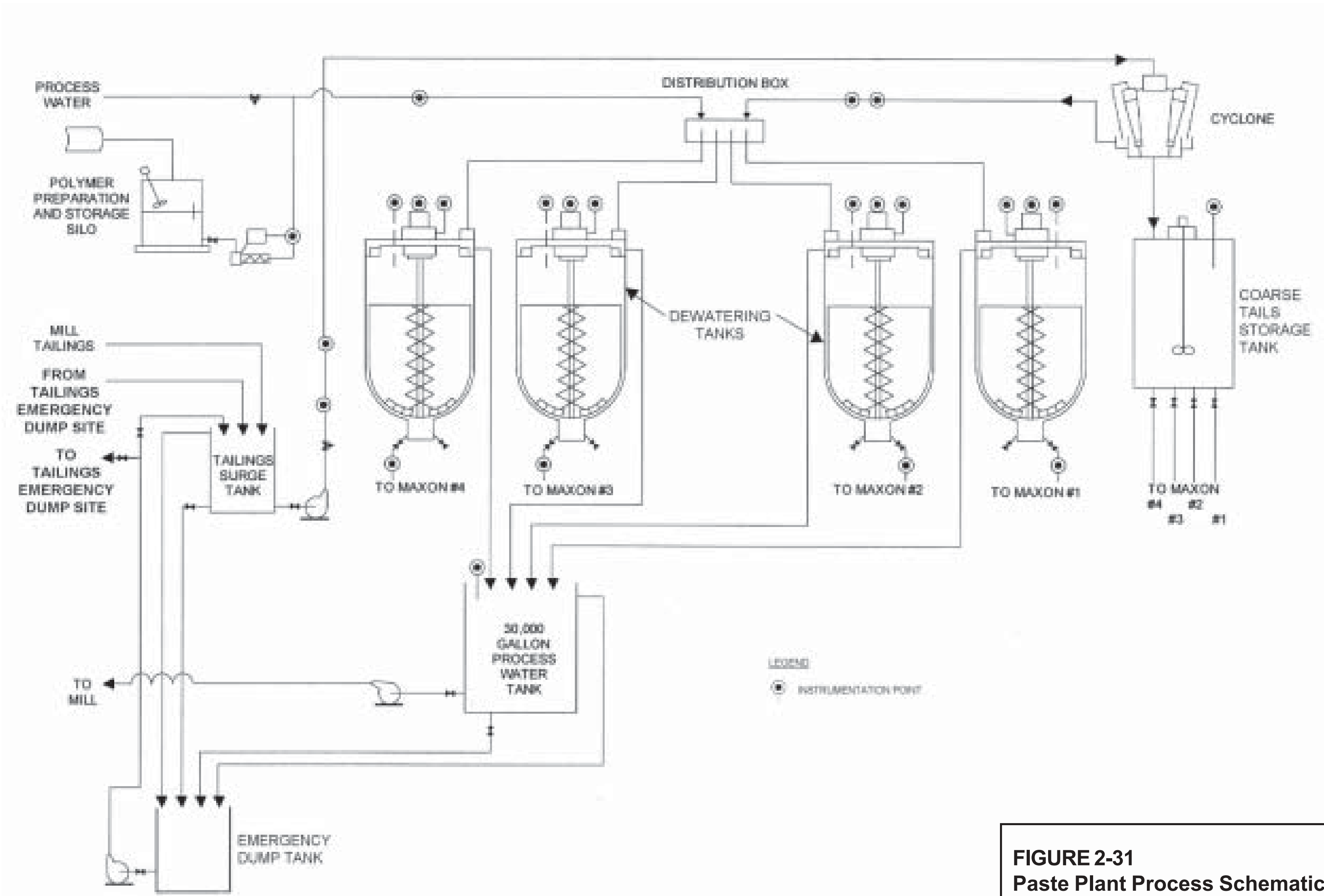
SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-29
Pipeline Corridor Drawing
Rock Creek Project



SOURCE: Golder Associates Ltd., Evaluation of Surface Paste Placement, 1996

FIGURE 2-30
Paste Plant Process Schematic - Paste Production and Mixing
Rock Creek Project



SOURCE: Golder Associates Ltd., Evaluation of Surface Paste Placement, 1996

FIGURE 2-31
Paste Plant Process Schematic - Dewatering of Tailings Slurry
Rock Creek Project

The success of the paste process is dependent on the strict control of paste parameters such as moisture content. Prior to the implementation of a paste program, Sterling would be required to develop and submit for Agency approval a comprehensive paste plant operations manual. This manual would address plant operations, paste parameter tolerances, contingencies for paste not meeting specifications, monitoring of the paste production process, and reporting to the Agencies. The technical advisory board empaneled to assist with the design review of the paste impoundment would assist in the development of the QA/QC protocols.

The full plant tailings paste would be produced by combining the fine tailings paste from the dewatering tanks, the coarser tailings in the coarse tails storage tank, and additional process water as needed. Supplemental material such as a binder (Portland cement[13], fly ash, or slag cement) or seed and/or fertilizer to facilitate reclamation would be added as needed. Each dewatering tank would have a separate mixer capable of handling the maximum discharge from the dewatering tank plus the coarse material from the storage tank. The paste production would be monitored and regulated so that the resultant paste would have a consistency comparable to concrete exhibiting a 7-inch slump; this means positive displacement pumps would transport the paste via a high-pressure pipeline to the disposal location at the tailings paste facility.

The dewatering tanks would be designed to allow for continuous feed of tailings and production of paste even when one tank was off line for maintenance or repairs. The surge capacity of the dewatering tanks and the coarse tailings agitated storage tank would allow the paste production system to be shut down for 7 hours without stopping the tailings slurry feed from the mill or before using a tailings slurry feed containment site adjacent to the plant. In addition, each mixer has a surge capacity of 15 tons or approximately 10 minutes of down time for one mixer/pump pair without shutting down the paste production process.

A 7-acre contingency tailings slurry feed containment site would be placed near the paste production plant to contain approximately 6 days of tailings production should the paste production plant be totally disabled or in the event of a major failure beyond the control of the plant design (see Figure 2-26). This facility would be designed using traditional slurry impoundment design methods with a dam or embankment and would be lined with low permeability native materials (clay-type soils) and a synthetic liner to control seepage. The tailings stored in the containment pond would be dredged from the pond and reintroduced into the plant for disposal as a paste after the plant resumed operation. A paste plant shutdown of more than 6 days would result in the suspension of milling.

Tailings Paste Deposition. The location of the paste plant was selected to utilize a hillside location adjacent to the paste facility for convenient tailings materials handling and disposal. The paste plant design provides operational flexibility and avoids duplication in pump transport. Positive displacement pumps with a combined design capacity of approximately 680 dry tph would be used in an arrangement that would allow one pump to be shut down for either preventative or unscheduled maintenance. The paste would be pumped to the paste delivery system.

---

[13] Addition of cement to the tailings paste would be dependent upon the results of geochemical data collected from the evaluation adit (see Acid Rock Drainage and Metals Leaching Plan and the Evaluation Adit Data Evaluation Plan in Appendix K for more detail). Any requirement for cement as a means to prevent or minimize acid rock drainage could further be modified over time as a result of continued geochemical testing during mine operation. Cement could also be required if the technical review panel determined during final design reviews it was necessary for stability purposes.

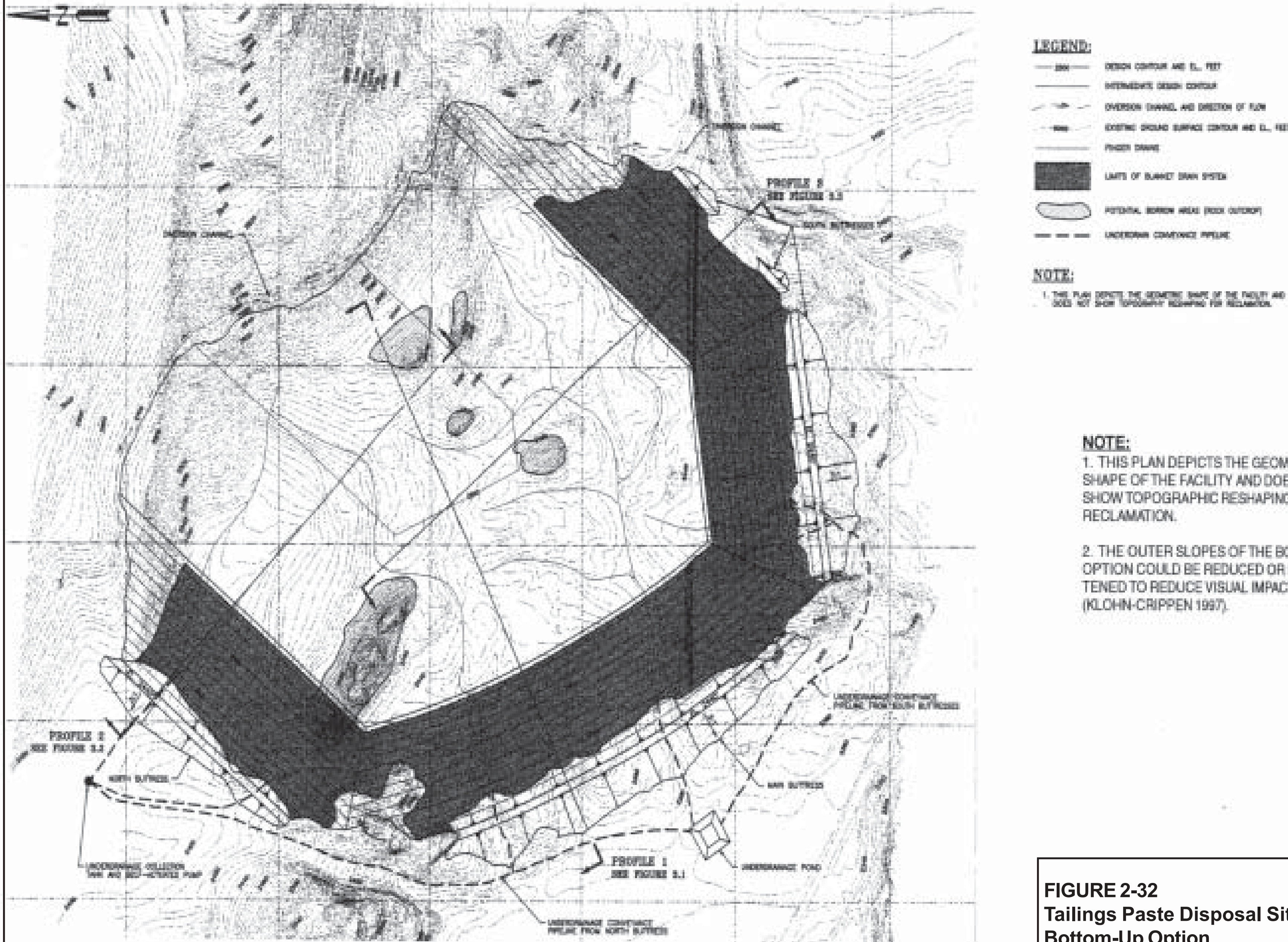
There are two primary paste deposition options for Alternative V and one combined paste deposition option. These options are named according to the direction in which the paste is deposited and the landform is built (see Figures 2-32, 2-33, and 2-34). These options are termed Bottom-Up option (Alternative V-a), Top-Down option (Alternative V-b), and Combined option (Alternative V-c).

The Bottom-Up option would initially involve spigotting paste from the lower elevations and moving the spigot point upslope. The Top-Down option would result in deposition of the paste by spigotting the paste from the upper-most slopes and moving the spigot point towards the highway; the deposit would gradually progress to the southern most portion of the deposit site. Under the Combined option the direction of paste deposit and spigot location would depend on the method being used at the time as described for the Bottom-Up and Top-Down options. The combined option would be used on a seasonal basis each year or alternate between a number of years with each of the first two options. The tailings paste facility would encompass approximately 324 acres for the paste facility and another 44 acres for associated features, such as soil stockpiles, under all options but acreage would vary slightly based on the final approved design.

A series of toe buttresses would be required for all options to assist in containing the paste on the downslope sides, improving slope stability, and retaining sediment eroding off the slopes. Under these conceptual designs, the buttresses would reach an ultimate height of approximately 80 feet (elevation of 2440 feet), but the actual height would depend upon engineering behavior of foundation soils to be analyzed in more detail in the final design. The toe buttresses would be located in approximately the same location as the starter-dams for the tailings impoundment designs in Alternatives II through IV. The buttresses would be built during initial stages of mine development as rock was salvaged from within the proposed paste deposit footprint or became available during adit construction. The buttresses would consist predominantly of rockfill totaling approximately 1,360,000 cubic yards. The rockfill could be obtained from rock outcrops within the deposit site, borrow areas within the deposit site, and waste rock produced from mine adit development (see Table 2-13 for preliminary estimates of materials obtained from these sources). Waste rock from the adits would be hauled to the tailings paste facility site and used immediately for buttress construction to avoid rehandling this material or the need for a waste rock dump at the mill site. The waste rock could only be hauled between August 1st and March 31 to minimize impacts to harlequin ducks.

TABLE 2-13
Preliminary Volumes of Paste Facility Toe-Buttress Waste Rock Requirements

Source	Quantity (Cubic Yards)
Rock Outcrops	480,000
Borrow Areas	130,000
Mine Waste	750,000
Total	**1,360,000**



NOTE:

1. THIS PLAN DEPICTS THE GEOMETRIC SHAPE OF THE FACILITY AND DOES NOT SHOW TOPOGRAPHIC RESHAPING FOR RECLAMATION.

2. THE OUTER SLOPES OF THE BOTTOM-UP OPTION COULD BE REDUCED OR FLATTENED TO REDUCE VISUAL IMPACTS (KLOHN-CRIPPEN 1997).

SOURCE: Dames and Moore, Alternate Tailings Impoundment Design, 1992

FIGURE 2-32
Tailings Paste Disposal Site - Bottom-Up Option
Rock Creek Project

SOURCE: Dames and Moore, Alternate Tailings Impoundment Design, 1992

FIGURE 2-33
Tailings Paste Disposal Site - Top-Down Option
Rock Creek Project

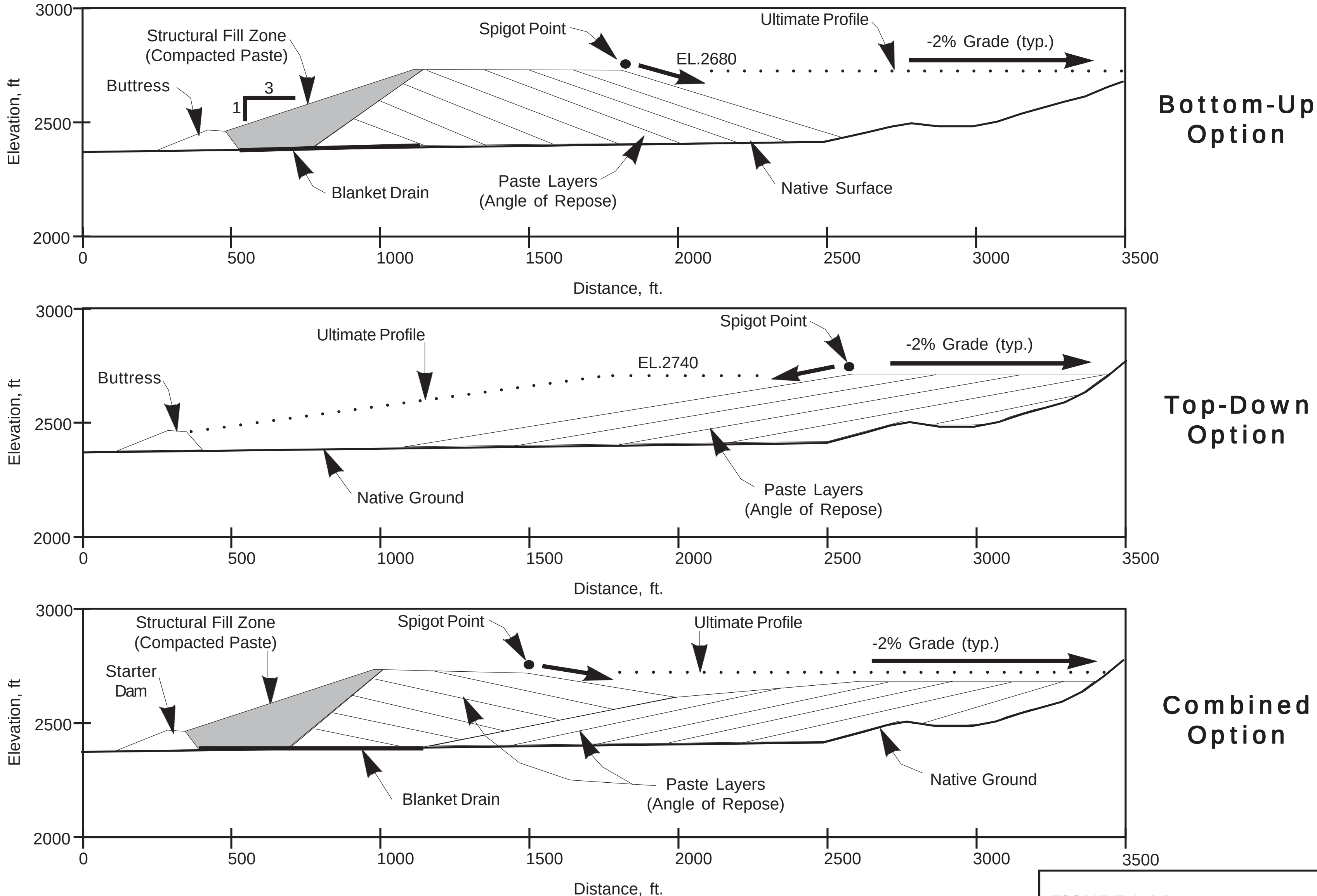


FIGURE 2-34
Paste Deposition Options
Cross Sections
Rock Creek Project

The paste pipeline would be located either on the crest of the toe buttress for the Bottom-Up option or along the upper end of the deposition site for the Top-Down option. The location of the spigot or spigots for the Combined option would depend upon the method(s) being used at the time. Under all options, a low load-bearing crawler crane would be used to position the pipe and spigotting would commence. Once a layer or a lift of paste had been completed, the crane, pipes, and spigot would be relocated further down the row onto the oldest portion of the previous paste layer, or to a new row if the previous one had been completed. A new layer of paste would then be spigotted onto the previous layer(s). There may be some delay in relocating the crane when using the Top-Down option as the paste would need to solidify or compact enough to support the equipment. Although earliest reports (Golder Associates 1996) proposed paste deposit lifts of 3 to 4 feet, a later report recommends that the lifts be reduced to 1 foot until actual field construction experience indicates that a thicker lift can be deposited to ensure paste facility stability (Knight Piesold 1997).

In the Bottom-Up option and the Bottom-Up portion of the Combined option, a structural zone of compacted paste would be constructed upslope of the toe buttresses to permit the construction of a 3:1 slope. The paste would be spigotted behind the structural zone at its angle of repose. The outer slope of the structural zone would crest at an elevation of approximately 2680 feet (320 feet high) (see Figure 2-32). The Top-Down option would be constructed at the angle of repose (approximately 5:1), resulting in longer overall side slopes than the Bottom-Up option. Compaction of slopes would only occur if found to be necessary under the Top-Down option. This would depend on actual field experience. The Top-Down option would have a crest of approximately 2740 feet (380 feet high); although the crest is slightly higher it would be positioned farther away from the highway (see Figure 2-33). The Combined option would have some flatter slopes on the upper portions of the deposit and steeper slopes closest to the highway. The Combined option would have an ultimate elevation somewhere between the first two options, the actual elevation would depend upon when the Bottom-Up component was begun relative to the Top-Down component. It may be possible in final design for either the Bottom-Up or combined option to flatten the outer slopes and deposit the remaining mass of the tailings facility closer to Government Mountain and away from Montana Highway 200 such that the resultant landform would more resemble the Top-Down option. Topographic relief of the upper surface of the paste facility constructed by any of the options could be created by preferential spigotting of the paste and the paste could also be reshaped by dozer to achieve the final grading prior to reclamation. However, this does not mean that the outer slopes of the Bottom-Up option cannot be reduced or flattened to reduce visual effects. Manipulation of the paste to vary the side slopes could be done more easily during construction under the Top-Down option than under the Bottom-Up option. The paste material would be reclaimed on the surface and outer edges when final grade was achieved and timing of reclamation varies somewhat depending upon the option used (see Reclamation).

A system of basin drains would be incorporated into any of the options to maximize recovery of seepage of residual process water in the paste and storm water infiltration through the paste. A blanket drain adjacent to the outer slopes and beneath the compacted structural zone would be constructed to maintain a drainage of the structural zone under the Bottom-Up option and the Bottom-Up portion of the Combined option. For all options an extensive system of finger drains would be constructed beneath the paste facility. Conceptually these drains would consist of 4-inch diameter, slotted pipe surrounded by a zone of crushed rock 10 feet wide and 2 feet thick. The actual location of these finger drains would be determined during the final design. The water collected by the finger drains would be routed to a single collection pond located outside the main buttresses (see figures 2-32 and 2-33), pumped back to the paste plant and, if not needed for paste production, returned to the mill for reuse. Seepage water collected in the paste facility underdrain after mine shutdown would be routed to the water treatment facility for treatment. This procedure would continue until such time that the quality of seepage water would allow direct discharge without treatment.

Land would be cleared and topsoil salvaged in advance of paste deposition (see Reclamation for more detail). While a tailings impoundment would require the entire footprint of the impoundment to be cleared or disturbed prior to construction of the impoundment, the paste deposit alternative restricts disturbance to the active areas. There would be more land disturbed initially under the Bottom-Up option due to construction of the toe buttresses and blanket drain than under the Top-Down option (see Table 2-14).

TABLE 2-14
Summary of Estimated Active Versus Reclaimed Areas Over Time for Alternative Paste Facility Construction Scenarios

Year	Area of Active Disturbance	Area at Final Grade (reclaimable area)	Total Area	Comments
BOTTOM-UP CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	78 acres	0 acres	78 acres	Southern face under construction
YR 19	190 acres	0 acres	190 acres	Southern face completed
YR 21	97 acres	115 acres	212 acres	25% of top completed to final elevation
YR 31	74 acres	190 acres	264 acres	50% of top completed to final elevation
YR 33	41 acres	250 acres	291 acres	75% of top completed to final elevation
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation
TOP-DOWN CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	57 acres	2 acres	59 acres	5:1 depositional surface started across ½ of northern boundary
YR 10	110 acres	4 acres	114 acres	5:1 depositional surface completed across northern boundary
YR 14	105 acres	48 acres	153 acres	25% of top completed to final elevation
YR 20	119 acres	80 acres	199 acres	50% of top completed to final elevation
YR 26	121 acres	135 acres	255 acres	75% of top completed to final elevation
YR 33	93 acres	211 acres	304 acres	
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation

Note: Disturbed acreages do not include soil stripping in advance of paste deposition. If soil is removed for a distance of 500 feet in advance of paste deposition, an additional 30 acres of disturbance can be assumed.

Source: Hydrometrics 1997a

Storm Water Control

All storm water detention and retention ponds would be lined with 30-mil HDPE liners for primary seepage containment. The mill pad underdrains would provide secondary collection for the mill site. Underdrains or blanket drains according to final design specifications would provide secondary collection of storm water seepage through the tailings paste facility.

The lined storm water pond at the mill would be enlarged along with all diversions to handle a 100-year/24-hour storm event. Storm water at the adit portal and mill sites would be collected and recycled to the mill for reuse. Water collected from the outer slopes of the mill pad and the mill site underdrains would only be allowed to discharge under conditions specified in the revised MPDES permit (see Appendix D). Otherwise water from the underdrain containment pond would be pumped back to the mill for reuse. Storm water diverted from undisturbed lands above and adjacent to the mill would be discharged through overland flow diffusers or energy dissipating outlets outside the 300-foot streamside-buffer zone (see Figure 2-27).

Since the tailings paste facility and the undisturbed portion of the disposal site would not retain storm water like an impoundment, one or two lined storm water ponds would be constructed at the lower elevations in the tailings disposal site (see Figure 2-26). These ponds would be removed and reclaimed after the tailings facility was completed and reclaimed. These ponds also would be sized to handle the runoff from the active portion of the tailings paste facility site during an 100-year/24-hour storm event. Water collected in the storm water pond could be pumped to the paste plant and then to the mill as process water or used for irrigating reclaimed portions of the tailings paste facility if water quality was acceptable.

Sediment and runoff control of the tailings facility would be handled in two methods. First, limiting unreclaimed areas to the active disposal areas would minimize sediment and runoff. Second, localized sediment retention structures and BMP's would be used in the downslope perimeter of the active panels for control, sampling and recovery of drainage from the tailings paste facility, sediment, and storm water runoff. These structures and collection ditches would act as storm water diversions to channel the water and sediment from the active portion of the tailings paste facility into the tailings facility site storm water ponds. The ditches would also be sized to accommodate a 100-year/24-hour storm event.

Storm water from undisturbed lands above the tailings paste facility would be diverted around the active portions into the north fork of Miller Gulch and to Rock Creek during mine operations. Runoff from reclaimed and fully revegetated, stabilized portions of the tailings paste facility would be diverted to settling basins before mixing with runoff from undisturbed areas. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings paste facility would be unlined and would discharge through a constructed drainage network to existing drainages. However, settling ponds on the upper portion of the paste facility would require lining to prevent excess infiltration of water. Storm water from reclaimed areas that were not fully stabilized would be captured along with runoff from the active areas of the tailings paste facility. Undisturbed portions of the paste facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the storm water pond. All these diversions would be sized to handle a 100-year/24-hour storm event. These diversions would be reclaimed and permanent drainage ways established when mine operations ended and the site was fully reclaimed.

The final design for the storm water and sediment control structures at the paste facility must be approved by the Agencies prior to being constructed.

Water Use and Management

A detailed water balance would be refined annually for estimating water use, seepage, and discharges. Actual volumes for a number of water balance variables would be measured to update previously projected calculations. These would include measurements of precipitation; evaporation; mine and adit inflow, outflow, and storage; inflow to the tailings facility; seepage from the tailings facility; seepage collected by the perimeter recovery system; outflow to the treatment system; and discharge to the Clark Fork River.

Baseline data and the similarity of site conditions to the Troy Mine site indicate that acid drainage is not expected. Additional data collected during evaluation adit construction, mine development, and operations would be required to refine predictions of the potential for long-term acid drainage, and to assess the acid drainage potential of waste rock prior to its use as construction material. A representative underground sampling and acid-base testing and monitoring program would be developed and implemented on rock from the adits, ore zones, above and below the ore zones, and in the barren zone as described in Appendix K. The results would help identify materials to be segregated to prevent production of acid leachate or drainage.

The agencies would require a bond for long-term monitoring and maintenance, and possible long term post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

Evaluation Adit Construction Water Requirements. Water requirements for driving the evaluation adit would average 30 gallons per minute (gpm) during the drilling cycle. Additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop.

Water for drilling would initially be hauled to the site from a makeup water well at the confluence of Rock Creek and the Clark Fork River (see Figure 2-26). A lined pond, with a capacity of about 30,000 gallons, would be constructed near the evaluation adit portal to collect site runoff and store the hauled water. A barrier would be erected around the pond to exclude wildlife. A diversion berm would be constructed above the portal and soil stockpile to divert natural runoff around disturbed areas (Figure 2-28).

A pump in this pond would provide water for drilling during the initial evaluation adit construction phase. Excess water encountered in the adit during this phase would be pumped to the pond. After the adit had advanced approximately 350 feet, an 18-foot by 18-foot by 40-foot (97,000-gallon) mine sump would be excavated to function as the evaluation adit water sump. An oil skimmer and pressure filter would be located at this sump to remove oils and grease and suspended solids from the water supply.

Excess water from the adit sump and pond overflow would be pumped through a temporary 6-inch polyethylene pipeline through a biotreatment system and an ion exchange treatment plant for treatment prior to discharge. This pipe would be removed when the mine reached the evaluation adit; then the evaluation adit water would be routed through the mine water drainage and collection system described below. Discharges must comply with the proposed MPDES limits. The evaluation adit is estimated to generate approximately 168 gpm once it was fully constructed.

Potable water would be trucked to the adit site and stored in a tank in the shop until a suitable source was found in the adit. Two wells would be installed to supply the support facility. Sewage from the adit shop and the office and the mine dry at the support facilities would drain to conventional septic tanks and drainfield systems. If, according to DEQ, either or both of the proposed sites or their alternate locations were not suitable for a drainfield, then a holding tank would be installed. This tank would be pumped periodically and hauled to a municipal sewage disposal facility (ASARCO Incorporated 1992).

Mine Operation Requirements. Water use and supply for evaluation and underground mining operations would remain the same as described for Alternatives II through IV. Figure 2-35 provides a schematic diagram of project water handling for mine operation during the end of mine life. Table 2-15 provides additional water balance detail through the mine production period.

Additional water balance detail can be found in the applicant's Alternative V Water Management Plan (Hydrometrics, Inc. 1997). During full production, the mill would require 3,788 gpm of process water. Process water for the mill would come from five sources: reclaimed tailings slurry water, mine discharge water, reclaimed concentrate slurry water, mill site and tailings paste facility site storm water, and if needed, make-up-well water. Process water would remain in an essentially closed loop. Approximately 5 to 10 percent of the flow in the process loop will be diverted to the waste water treatment system and fresh water added to the circuit on an ongoing basis to prevent buildup of excess constituents in the process water. Because the amount of mine water discharge and available reclaim water from the tailings paste plant and the dewatering system at the rail loadout would vary seasonally, a make-up water well has been planned in the Clark Fork River alluvium capable of supplying full make-up water requirements. The location of this proposed well near the confluence of Rock Creek and the Clark Fork River is shown on Figure 2-26. A buried 12-inch steel pipeline would connect with an antisiphon device to the reclaim water line thus carrying water to the mill.

As illustrated in Figure 2-35, mine inflow not used for mill makeup or stored in the mine would be routed to the water treatment facility prior to discharge in the Clark Fork River below Noxon Dam. The rate of mine inflow would vary throughout the mine's life in proportion to the total volume of ore excavated. The rate of mine inflow routed to the water treatment facility would also vary throughout the year in response to climatic conditions, especially precipitation. Figure 2-36 illustrates the estimated average annual flow to the water treatment facility by project year. The table also illustrates the anticipated maximum and minimum flow to the water treatment facility by project year. Discharge flow is estimated at 550 gpm–year 1; 937.7 gpm--year 10; 1,342.7 gpm–year 20; and 2,043.1 gpm--year 30 or end of mine life.

By the end of mine operation, up to 207.7 million gallons of mine and adit water potentially would require storage in an underground reservoir. This reservoir could require a 64-acre pond 10 feet deep. Excess water would be held in or released from storage depending on the ability of the wastewater treatment systems to treat the volume of water to MPDES permit limits. For example, should a problem develop with the mine water treatment system, excess mine water could be stored in the mine for a short time until the problem with the water treatment system was corrected. During the wet season, excess mine water would likely be stored underground. During the dry season, stored water would be released and directed to the water treatment system.

Mine effluent typically would be expected to contain high concentrations of suspended solids at a relatively neutral pH and some dissolved metals similar to the Troy mine. This would contribute a significant portion of the total metals load to mine effluent. Initial removal of suspended solids would be accomplished using two 100,000-gallon mine sumps to settle out the solids, by adding chemicals to flocculate (clump) the particles if necessary, and subsequent filtration. Water would be pumped from the mining face to these sumps for the main mine water supply.

TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Adit Balance															
Inflow															
Adit Inflow	46	694.3	709.1	765.4	821.8	878.3	934.7	990.9	1047.4	1103.9	1160.2	1442.1	1724.2	2006.0	2288.1
Ore Water	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
Outflow															
To Biotreatment	119	327.4	173	215.1	266.8	303.4	345.2	383.3	425.5	466.8	541.2	759.4	852.2	1132.9	1392.1
Mill Reservior	120	366.9	536.1	548.2	544.7	556.2	559.1	561.9	561.2	561.1	561.1	496.7	562.8	563.2	549.0
Mine Workings Storage	121	0	0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	185.9	309.1	310.0	347.0
Ore Water	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mill Balance															
Inflow															
Water in Ore	60	19.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
From Mill Reservoir	63	2485.0	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7
Outflow															
Concentrate Slurry	61	41.6	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
Tailings	62	2462.8	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paste Plant Balance															
Inflow															
Tailings	100	2462.8	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0	3726.0
Concentrate Load-Out Facility Return	103	39.8	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2
Outflow															
Paste to Paste Fill Area	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
Dust Suppression & Irrigation	103	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
Paste Plant Reclaim	104	2238.7	3387.0	3387.0	3387.0	3387.0	3387.0	3387.0	3385.9	3385.9	3385.9	3383.5	3383.5	3382.4	3382.4
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0.0	0
Mill Reservoir Balance															
Inflow															
Paste Fill Area Runoff	107	34.3	42.3	50.0	81.8	81.8	81.8	81.8	83.4	83.6	83.6	120.9	84.0	84.7	84.7
Paste Plant Reclaim	108	2238.7	3387.0	3387.0	3387.0	3387.0	3387.0	3387.0	3385.9	3385.9	3385.9	3383.5	3383.5	3382.4	3382.4
Waste Water	109	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
Plant Runoff	110	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	82.3	53.1	53.1	53.1
Makeup From Mine Water	114	366.9	536.1	548.2	544.7	556.2	559.1	561.9	561.2	561.1	561.1	496.7	562.8	563.2	549.2
Makeup From Contingency Well	115	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outflow															
To Mill	111	2485.0	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7	3759.7
Overflow to Biotreatment System	113	222.6	273.4	293.2	321.5	333.0	335.8	338.7	338.6	338.6	338.6	338.4	338.3	338.2	324.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

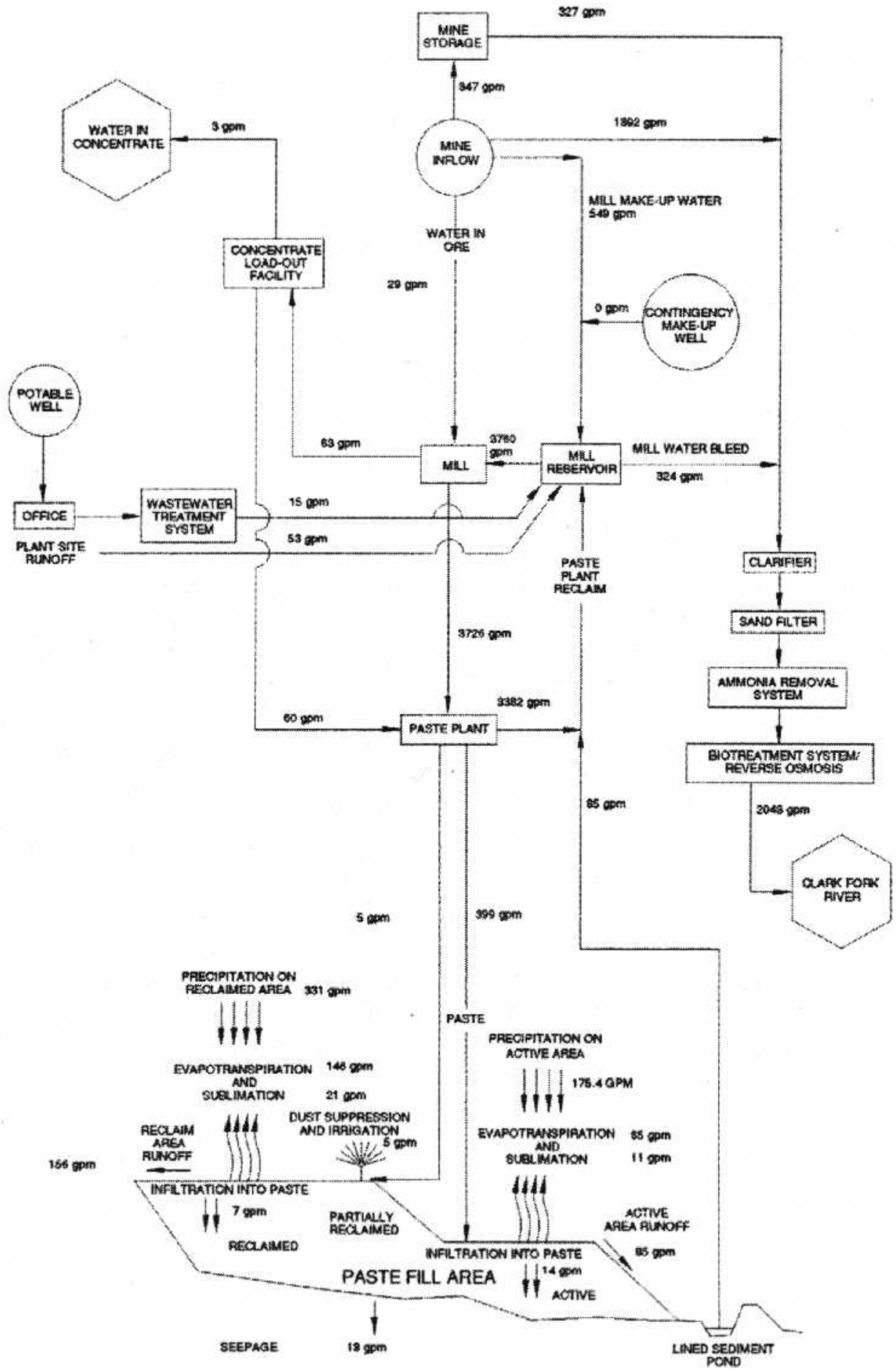
TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V (Cont'd)

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Paste Fill Area Balance															
Paste Fill Active Area Calculations															
Inflow															
Precipitation	86	87.6	87.6	104.0	169.3	169.3	169.3	169.3	172.8	173.1	173.1	257.3	174.1	175.4	175.4
Water in Paste from Paste Plant	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
Outflow															
Sublimation	90	5.6	5.6	5.6	10.8	10.8	10.8	10.8	11.0	11.0	11.0	10.9	11.1	11.2	11.2
Infiltration of Precip. into Paste	93	7.0	7.0	8.3	13.5	13.5	13.5	13.5	13.5	13.8	13.8	20.6	13.9	14.0	14.0
Evapotranspiration	94	32.7	32.7	40.1	63.3	63.3	63.3	63.3	64.5	64.6	64.6	104.9	65.0	65.5	65.5
Runoff Return to Paste Plant	95	42.3	42.3	50.0	81.8	81.8	81.8	81.8	83.4	83.6	83.6	120.9	84.0	84.7	84.7
Water Retained in Paste	102	263.9	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2	399.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paste Fill Reclaimed Area Calculations															
Inflow															
Precipitation	72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.6	79.2	79.2	251.4	252.2	330.6	330.6
Dust Supression & Irrigation	83	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
Outflow															
Sublimation	76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	10.6	16.1	21.1	21.1
Infiltration of Precip. into Paste	79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.6	1.6	5.0	5.0	6.6	6.6
Evapotranspiration	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.1	35.0	35.0	120.1	111.6	146.3	146.3
Runoff	81	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	37.5	37.5	115.7	119.5	156.7	156.7
Dust Supression & Irrigation	83	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	3.5	3.6	4.7	4.7
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mine Workings Storage Balance															
Inflow															
Inflow to Storage	124	0.0	0.0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	185.9	309.1	310.0	347.0
Outflow															
Outflow from Storage	125	0.0	0.0	2.1	1030	18.6	30.5	45.7	60.7	76.0	57.9	67.7	152.2	328.9	327.0
Change in Storage	s121-f122	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.2	157.0	-18.9	20.0
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment System															
Inflow															
Direct flow From Mine Workings	130	327.4	173.0	215.1	266.8	303.4	345.2	383.3	425.5	466.8	541.2	759.4	852.2	1132.9	1392.1
Flow from Mine Workings Storage	132	0.0	0.0	2.1	10.3	18.6	30.5	45.7	60.7	76.0	57.9	67.7	152.2	328.9	327.0
Overflow from Mill Reservoir	131	222.6	273.4	293.2	321.5	333.0	335.8	338.7	338.6	338.6	338.6	338.4	338.3	338.2	324.0

TABLE 2-15
Water Balance Summary - Average Mine Production Yearly Project Flows - Alternative V (Cont'd)

	Line #	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Outflow															
To Clark Fork River	133	550.0	446.4	510.4	598.6	655.0	711.5	767.7	824.8	881.4	937.7	1165.5	1342.7	1800.0	2043.1
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concentrate Load-Out Facility															
Inflow															
Concentrate Slurry	68	41.6	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
Outflow															
Water in Concentrate	69	1.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Concentrate Return Water	70	39.8	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2
	SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: All values are in gallons per minute (gpm).
Line # = Line number from water balance model, see Water Management Plan for Alternative V (ASARCO 1997).



SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-35
Alternative V Schematic Diagram of Project Water Handling Production Final Year
Rock Creek Project

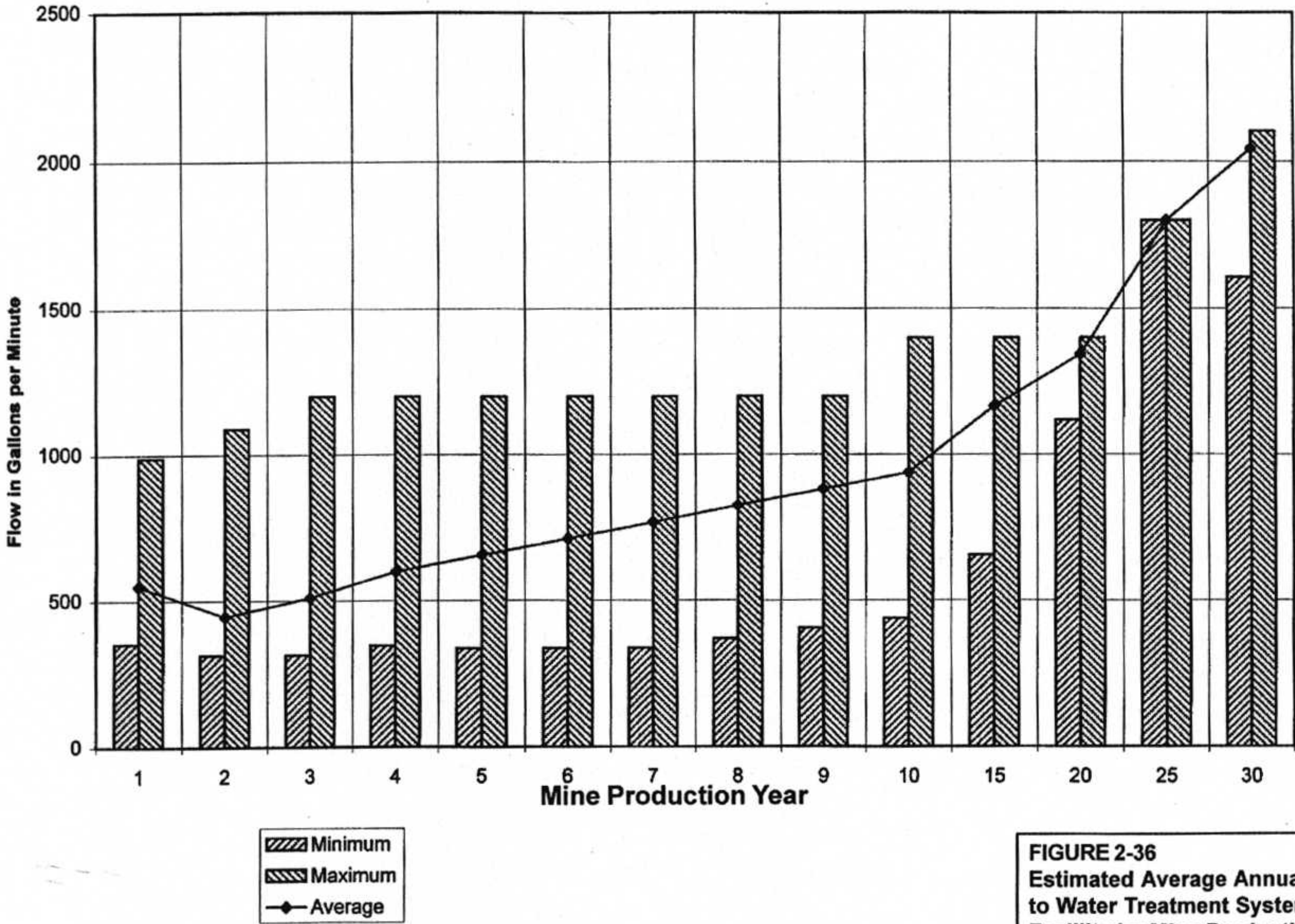


FIGURE 2-36
Estimated Average Annual Flow to Water Treatment System Facillity by Mine Production Year
Rock Creek Project

Segregation of water within the mine and underground workings would be considered in the later stages of active mining. Such segregation could potentially reduce the volume of water requiring treatment prior to discharge. Segregation would be accomplished by separating ground water inflow from non-active mining areas and conveying this water in a separate pipeline to the water treatment facility. This water should be lower in suspended solids, heavy metals, ammonia and nitrate than water from the active mining area. This water may not require treatment prior to discharge or may only require partial treatment to meet discharge permit limits.

Water originating within the mill site also would be collected and routed to a drainage sump at the mill site for use as process water. Water filters and an oil skimmer would be located in the mill area to remove suspended solids and oil and grease from the water supply. Filter backwash would be sent with tailings to the tailings paste plant. Filtered water from mine and mill sumps in excess of the requirements for mine development and mill make-up water would flow through a buried pipeline to the water treatment facility before discharging to the Clark Fork River.

Reclaim water from the paste plant and the concentrate dewaterer at the rail loadout would either be returned to the mill for reuse as process water or to the waste water treatment facility for treatment prior to discharge to the Clark Fork River. This excess water would be discharged through a clarifier and sand filtration unit or other similar unit to remove suspended solids before being routed to the water treatment system for nitrate removal.

General Waste Water Treatment. Two waste water treatment systems designed primarily for nitrate removal would be installed: an anoxic (low oxygen content) semi-passive biotreatment system and a reverse osmosis treatment system. Neither system would be designated as the primary or back-up system. A portable version of the reverse osmosis system would be built to handle mine discharge water from the evaluation adit and placed at the support facilities site. This unit would be moved to the water treatment facility site if a decision was made to continue with the mining operation and expanded to accommodate greater flows that would occur during mine construction and operation. It may take some time for the biological treatment system to become fully operational during mine start-up when variable flows and conditions would be expected; the reverse osmosis system would have the primary water treatment role during evaluation and mine start-up compared to the passive biotreatment system under Alternative II. Sterling expects that the biotreatment system would become the main treatment system; however, the reverse osmosis system would still be available to operate during bioreactor upsets or if higher treatment efficiencies were required. Also as noted, the quantity (flow rate) of excess mine water directed to the water treatment facility could be reduced during such situations by diverting excess mine water to the in-mine storage area.

A schematic diagram of the biotreatment waste water process is found in Figure 2-37. Figure 2-37 displays the proposed layout of the water treatment facilities. At the final design stage, modifications to the treatment system may be made depending on a number of factors, including the actual discharge water characteristics, the final MPDES permit limits, and the technology available at the time. All modifications would still have to result in compliance with MPDES permit limits and not result in impacts significantly different from or greater than those identified in the final EIS. If any did occur, then the modifications would be subject to the appropriate level of additional MEPA/NEPA analysis.

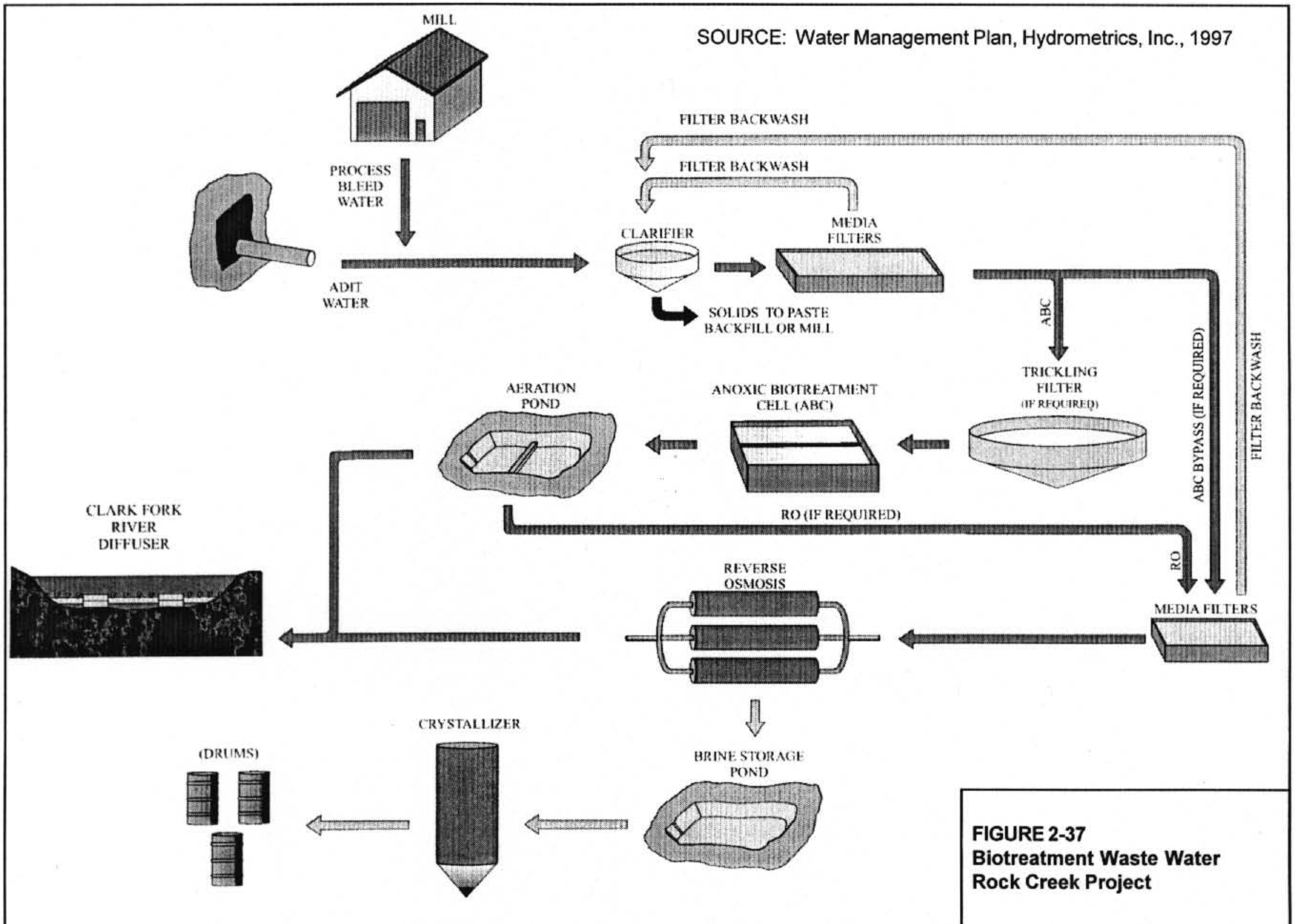
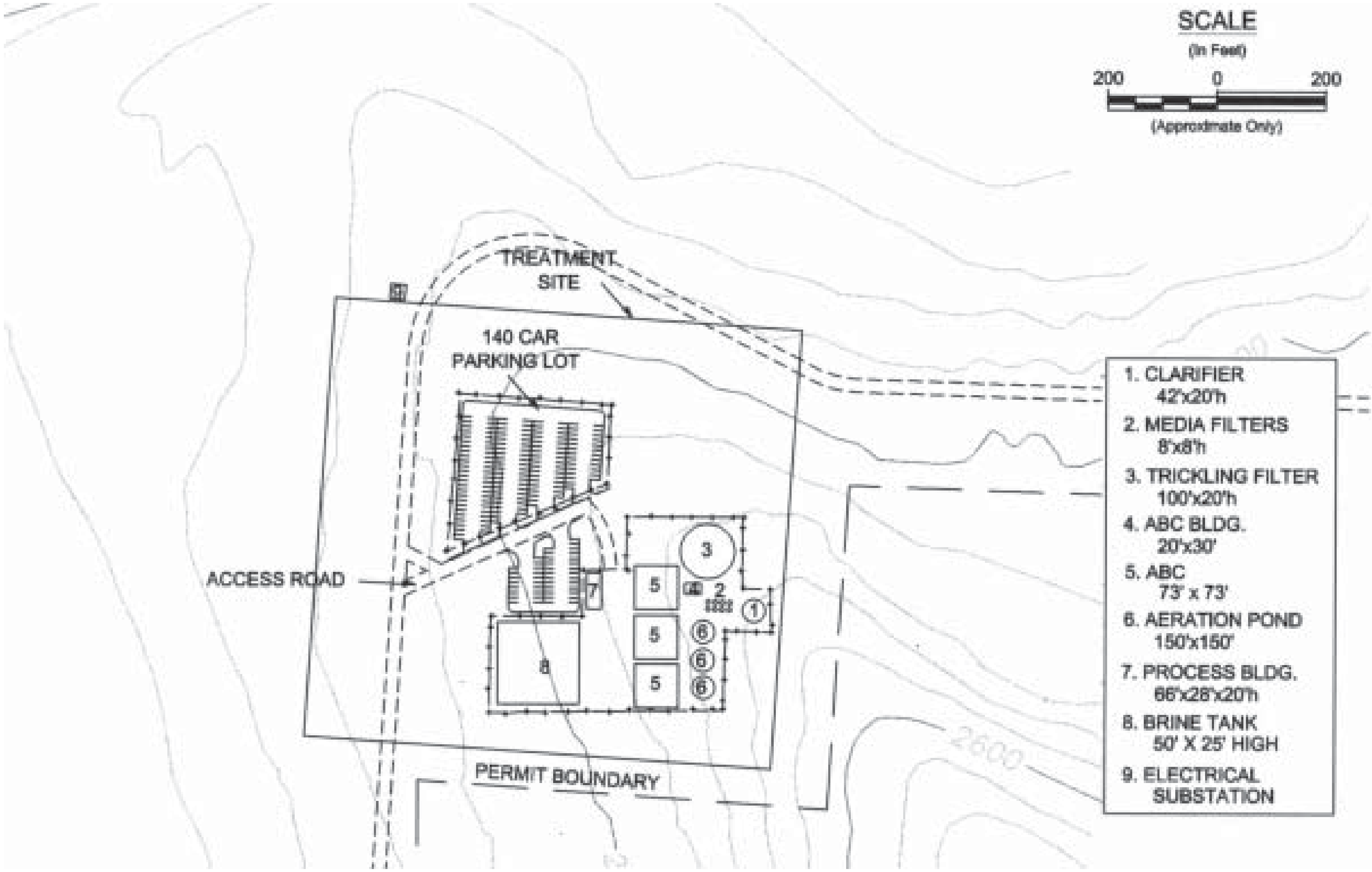


FIGURE 2-37
Biotreatment Waste Water
Rock Creek Project



NOTE:
As illustrated, the aeration pond is sized for 2,300 gpm operation.
All other facilities are sized for 650 gpm operation.

SOURCE: Water Management Plan, Hydrometrics, Inc., 1997

FIGURE 2-38
Water Treatment Facility Plan
Rock Creek Project

Mine water would flow through a buried pipeline to the water treatment facility. Sedimentation tanks (clarifiers) would remove a high percentage of suspended solids in the discharge water (at least 95 percent). The sludge from the clarifiers would be taken to the paste plant and incorporated into the tailings paste for deposition. Water leaving the clarifiers would also flow through sand filters for final suspended solids removal (80 percent of the remaining fraction). The partially treated water would then be directed to one or both of the water treatment systems depending on system capacity, amount of flow, and other variable conditions.

Anoxic Biotreatment System. The semi-passive biological system for treating mine water would consist of one or more anoxic biotreatment cells, containing gravel-packed, attached-growth denitrification reactors. An in-ground concrete biotreatment cell designed to treat 650 gpm would be 6 feet deep and 73 x 73 feet in area (5,330 ft^2). Four of these wells would be constructed to treat 2,300 gpm (maximum design flow). These cell dimensions are based on preliminary design data for 80 percent nitrate-nitrogen removal at 6°C.

The pretreated (clarified and filtered) water would flow through a trickling filter to convert the ammonia to nitrate (nitrification). The trickling filter may need to be enclosed or insulated to allow for proper functioning during colder seasons.

The biotreatment process would rely on methanol as the carbon source for the denitrification process instead of the manure and straw included in the passive biotreatment system proposed and discussed for Alternatives II through IV. Methanol at a concentration of approximately 60 mg/L would be continually added to the influent water. Methanol concentrations would be monitored and adjusted as necessary to achieve optimal nitrogen removal. A 300-gallon tank (approximate volume) would be located adjacent to the biotreatment system building for initial use of the biotreatment process. A larger tank would be installed if biotreatment proves to be successful. Daily methanol consumption, if the biotreatment system was the primary waste water treatment system, would range from several gallons during initial startup to approximately 250 gallons during maximum discharge of 2,300 gpm. Phosphorus may also need to be added for microbial growth. It is estimated that approximately 1 milligram of phosphate (as phosphorus) would have to be added for every 30 milligrams of nitrate (as nitrogen) removed.

Mine water and methanol would enter the bottom of the biotreatment cell(s), and upwards flow through the cells would be controlled by a pump. The cell(s) would be filled with gravel and inoculated with several hundred gallons of sludge taken from the nitrogen-removal recycle loop at the Kalispell wastewater treatment plant. The cell(s) should not require reinoculation. The biotreatment cell(s) would not generate sludge or reject material requiring disposal. Nitrate would be converted to nitrogen gas (denitrification) and methanol to carbon dioxide; these nontoxic gaseous by-products would be vented to the atmosphere. Relatively small amounts of biomass may be generated which would discharge to the aeration pond where it would be broken down.

After biological treatment for nitrate removal, the effluent would flow to an aeration pond with a 12-hour minimum residence time prior to reaching the final monitoring point before discharging to the Clark Fork River. The aeration pond would be lined with 30 mil HDPE. The aeration pond would include a calm pre-discharge zone and a multi-level discharge structure to minimize suspended solids in the effluent. Excess methanol and biomass from the biological nitrate removal system would be reduced through aerobic biological action. Dissolved hydrogen sulfide, if present, would also be reduced through aeration. However, sludge containing small quantities of heavy metals may build up in the aeration pond over time. Sampling of this sludge will be required to determine the most appropriate method of site reclamation after the mine is shut down and mine wastewater treatment is no longer required (see Revegetation). At the full flow rate of 2,300 gpm near the end of mine life, the required ten-foot-deep pond would encompass approximately one-half acre. If the effluent did not meet discharge limits, it would be returned to the treatment facility for further treatment.

Reverse Osmosis Water Treatment. Reverse osmosis (RO) was selected for several reasons as the second water treatment system instead of ion exchange, which was proposed in the draft EIS. The reverse osmosis system is less complex, requires less operator attention, generates a smaller waste stream, and has no added chemicals. In addition, reverse osmosis technology has been proven to be capable of removing dissolved pollutants, such as nitrate, from water in many large capacity waste water treatment facilities throughout the world. Because the reject water or waste stream cannot be easily disposed of at the project site, the reverse osmosis system would operate at a high recovery rate to minimize the waste volume.

The reverse osmosis would most likely be the primary waste water treatment system used during evaluation and early stages of mine operation. When the biotreatment system became fully operational, the reverse osmosis systems would primarily be used during biotreatment system upsets or maintenance. It may also be used as a polishing step when the effluent did not meet standards. During such an event a portion of the biotreatment system effluent would be treated with reverse osmosis such that the recombined effluent from both systems met the limits of the MPDES permit.

The reverse osmosis system would be housed in a building approximately 66 feet long, 28 feet wide, and 20 feet high. It would contain reverse osmosis units sufficient to treat flows up to 650 gpm, the maximum flow expected in year 5 of production and year 10 of project life. The modular nature of reverse osmosis would allow simple installation of additional reverse osmosis units if reverse osmosis were still required for the treatment of 100 percent of the mine discharge in later years of mine operation. These units are complete with high-pressure pumps, cartridge filters, membrane modules and all other necessary equipment. This operation would probably require one operator around-the clock initially and after operations had been finalized, only a day-shift operator. The clarifier and media filters would probably be located outside the reverse osmosis building.

Once the influent water had undergone pretreatment for removal of suspended solids, the reverse osmosis could run continuously and reduce dissolved ion concentrations, including nitrate, nitrite, ammonia, and metals, by more than 90 percent. As flows increased during the life of the project, additional modules could be incorporated easily into the existing facility. Routine maintenance would include instrument calibration, chemical cleaning, and periodic membrane replacement. Membranes would require replacement every three to five years.

Only minimal quantities of brine (liquid waste from the reverse osmosis process containing elevated levels of nitrate, nitrite, ammonia, metals, and other ions) would be generated if the biotreatment becomes the primary treatment system with occasional use of the reverse osmosis. The waste brine that is generated, approximately 10 percent of system inflow when reverse osmosis treatment is required, would either be stored and gradually blended back into the biotreatment treatment system or crystallized/evaporated. The waste would not be classified as a hazardous waste as defined in 40 CFR 261.21-261.25. The brine or crystallized solid would not be ignitable, corrosive, or reactive and it would be non-toxic based on EPA's Toxicity Characteristic Leaching Procedure (TCLP) criteria (Hydrometrics

1997a). Estimated concentrations of waste brine presume no nitrogen removal by biotreatment. Waste brine concentrations would decrease in direct proportion to nitrogen removal efficiencies in biotreatment.

The brine would be stored in 500,000 gallon, epoxy-coated, covered, vertical, bolted steel tanks (60 feet in diameter and 25 feet high). A single tank would provide 5 days of brine storage for the initial 650 gpm reverse osmosis facility. Three tanks would be required to hold approximately 5 days of brine storage for estimated maximum mine operation waste water flow of 2,300 gpm.

A crystallizer/evaporator would be installed on site to treat any reverse osmosis brine generated. The brine would be reduced to one 55-gallon drum of waste per day for every 250 gpm of water treated (one drum of crystallized solid waste per 360,000 gallons of water treated). This waste would either be stored in drums or in a tanker trailer based on the actual waste volume being produced. It is anticipated that over 99 percent of the heavy metals originally present in the mine wastewater would be removed by pretreatment through clarification and filtration prior to treatment in the reverse osmosis system so only one percent of the metals would remain in the crystallized brine. The end product would be a solid which could be disposed as a regulated waste in an approved landfill such as those in Missoula, Kalispell, and Spokane or used by fertilizer companies in western Montana, Idaho, eastern Washington, and Canada.

After excess water from the proposed project was treated by settling, filtration, and the waste water treatment systems, treated effluent would be discharged to the Clark Fork River from a proposed outfall and engineered in-stream diffuser downstream from Noxon Reservoir. The purpose of the diffuser would be to distribute treated water though a perforated steel pipe to allow more mixing with river water. The in-stream diffuser also would reduce discharge velocities.[14] The diffuser would be located approximately 750 feet above the confluence of the river and Rock Creek and would run the entire width of the river. The diffuser would need to be in place prior to construction of the evaluation adit for discharge of water generated during that phase of the project. Prior to installation, a design study would be performed to reevaluate streamflow conditions and streambed characteristics at the selected outfall location. The diffuser design would be finalized after the study was complete, and an appropriate method of anchoring would be selected. If the diffuser was relocated from the proposed location, the agencies would need to determine how or if that affected the impact of the discharge to the river and if the MPDES permit limits needed to be adjusted. If the changes were significant, then additional MEPA/NEPA analysis would probably be required.

A sewage treatment facility would be incorporated into the mill complex design. This facility would contain the standard aeration tank with activated sludge, a settling tank with a sludge return to the aeration tank, and a chlorine contact chamber. Effluent from the contact chamber would be directed to the tailings disposal system, and sludge would be disposed of at an approved off-site facility.

Transportation

Access to the evaluation adit and the minor improvements to FDR No. 2741 would remain the same as for Alternatives III and IV. During construction of the evaluation adit, access to the evaluation adit site would be via existing FDR No. 150 and Chicago Peak Road, FDR No. 2741, and a short spur

[14] The diffuser would be fixed at the bank on concrete thrust blocks and surrounded by cobble riprap to provide shoreline protection. It would lie in the river channel, perpendicular to the flow of the river. The perforations of the diffuser system would be designed to reduce the discharge velocity to less than 2 feet per second, and allow mixing to occur across a broad cross-sectional profile of the river.

road. Improvements to existing FDR No. 2741 would include a minimum road width of 14 feet, improved or added road turnouts about every 1,000 to 1,500 feet, and a reconditioning of the road surface for year-round use and maintenance. Minor amounts of clearing may be necessary for turnouts and for snowplowing. The short spur road would need a 14-foot wide surface to accommodate equipment. This work would be done in consultation with the Forest Service.

Employees would use the parking lot at the alternate support facility site along the existing FDR No. 150 (figures 2-26 and 2-28) and would be transported in four-wheel-drive vans to the adit along FDR Nos. 150 and 2741. This would limit mine-related traffic to the minimum number of vehicles needed to transport work crews and supplies to the adit.

Because of the year-long schedule for adit construction, it would be necessary to plow snow on FDR No. 2741 for one winter. Snowplowing for a portion of FDR No. 150 would occur over mine life. Snow removal and disposal would follow Forest Service guidelines.

FDR No. 150 would be realigned with Montana Highway 200 as described for Alternatives III and IV to meet applicable MDT siting requirements. This alternate route for FDR No. 150 would intersect Montana Highway 200, 0.23 miles west of FDR No. 1022 (McKay Creek Road). This route would then proceed westerly and northerly over NFS lands and Sterling land as for Alternatives III and IV. However, FDR No. 150 would connect to an old existing road in the vicinity of the waste water treatment plant if final siting proved the old road to be suitable. This modified alignment would take advantage of an existing road farther away from Rock Creek and reduces the amount of new construction. This existing road would be upgraded and paved and a new segment constructed to connect to existing FDR No. 150 approximately 0.25 miles above the confluence with Engle Creek as described for Alternative III. This alternate road would need to be constructed prior to closure of existing FDR No. 150 at the tailings facility site. FDR No. 150 below the mill would have minimum width shoulders to provide structural support to the driving lane. The shoulders would not be conducive to parking along road and no turnouts would be provided to minimize stopping along the road. Sterling would time its road closure schedule for FDR No. 150 to accommodate essential local access needs.

The relocated portions of FDR No. 150 and the parking lot at the proposed waste-water treatment facility site would be constructed during the first part of the development phase (year 2) to keep construction related-traffic away from Rock Creek, to provide a road capable of handling the expected mine construction-related and public levels of traffic, and to allow for busing of mine adit construction workers to the mill site and mine portal. Access to the evaluation adit support facilities, paste plant, and the tailings paste facility site from the mill would require mine vehicles to travel down FDR No. 150 to Montana Highway 200 and then northwest on the highway to Government Mountain Road and then southeast on FDR No. 150B.

All roads used during mine operation between the mill, the mine, the paste plant, the water treatment facility, the highway, and the rail loadout facility would be paved or graveled (see Table 2-16 and Figure 2-26). FDR No. 150 above the mine and the Chicago Peak Road, FDR No. 2741, would not be paved. The service road, FDR No. 150B, around the outer edge of the tailings disposal site from the paste plant to Government Mountain Road would be paved; a short stretch of maintenance road along the west side of the disposal site would be graveled. FDR No. 150B from the paste plant to the junction with FDR No. 150 would be reconstructed as a gravel road and used only for pipeline maintenance after mine production begins. FDR No.150B would be gated at both ends and access would be restricted to mine-related traffic. A 10-foot wide gravel maintenance road would be constructed along the cross-country portion of the discharge water pipeline between the Clark Fork River and FDR No. 150. A small parking lot for 6-8 vehicles would be required at the paste plant for operators and mine management vehicles and supply deliveries. Additional gravel roads or maintenance trails would be required to provide access to the utility corridor where it does not follow FDR No. 150. Sterling would be responsible for maintaining these mining-related roads and trails. Maintenance of FDR No. 150 would be Sterling's responsibility, unless additional use by the Forest Service or other interests warranted a cost-share agreement.

TABLE 2-16
Summary of Roads To Be Used
Under Alternative V

Road	Section	Type	Length	Width	Access
FDR No.150	Hwy 200 to mill site	Paved	5.04 mi	24 ft	Open
FDR No.150	Mill site to FDR No.2741	Gravel	2.8 mi	14 ft	Open
FDR No.2741	FDR No.150 to evaluation adit portal spur road	Gravel	4.6 mi	14 ft	Open only when there is no snow, plowed during year 1, but no public parking/turnarounds available during winter
FDR No.150B	FDR No.150B to paste plant road	Gravel	1.07 mi	14 ft	Locked gates/Sterling pipeline maintenance access only
FDR No.150B	Paste plant road to Government Mtn. Rd.	Paved	1.52 mi	14 ft	Sterling and supply traffic only
FDR No.150	Government Mtn. Rd. From FDR No.150B to rail loadout facility	Gravel	0.25 mi	24 ft	Open, county road
Access Rd.	FDR No.150 to parking area/waste water treatment plant	Paved	0.15 mi	24 ft	Sterling visitor, and supply traffic only
Access Rd.	North from 150B along west side of disposal site	Gravel	0.57 mi	10 ft	Sterling maintenance only
Access Rd.	From Hwy 200 to Clark Fork River	Gravel	0.75 mi	10 ft	Sterling pipeline maintenance only
Access Rd.	FDR No.150B to paste plant	Paved	0.98 mi	14 ft	Sterling and supply traffic only

One existing bridge on FDR No. 150 over Rock Creek near the mill site would be replaced. Bridges to be constructed or reconstructed over Engle and Rock creeks would be realigned nearly perpendicular to the stream. An extension to the culvert on the West Fork of Rock Creek above the last bridge on FDR No. 150 is proposed. The existing bridge over Rock Creek near the junction of FDR Nos. 150B and 150 would not be reconstructed because there would be no concentrate hauled from the mill to the rail loadout facility; however some repairs may be necessary to provide safe crossings for trucks hauling waste rock to the paste facility site during mine development. If this bridge deteriorated during mine operation and the Forest Service determined it was unsafe, it would be removed by Sterling. Road construction activities include: FDR No. 150 reconstruction in close proximity to Rock Creek, associated bridge construction, reconstruction below the proposed mill site would most likely be conducted during the last half of the year of evaluation adit construction between August 1 and March 31. Construction activities would take place only during periods of low flow and dry weather to minimize impacts to the stream and harlequin ducks.

Truck hauling of concentrate from the mill to the rail loadout facility would be replaced by pipeline transport of the concentrate. This would eliminate eight trucks per day making the round trip between the mill and the loadout facility.

Prior to mine construction, Sterling must submit a traffic management plan to reduce total average daily traffic (ADT) to the mill site and to mitigate impacts on harlequin duck as well as grizzly bears. This plan would address evaluation, construction,[15] and operation mine-related traffic (excluding public recreation, Forest Service, logging traffic and other private and public traffic). A travel lane would need to be maintained for traffic on FDR No. 150 during road construction and reconstruction. The traffic plan would also need to allow private landowners reasonable access to their property, and public access to NFS lands. In addition, emergency medical access to the mill and mine sites would need to be considered in the plan. The plan must include provisions for busing employees during mine construction and operation between the waste water treatment facility area and the mill and mine. Mine construction workers would be bused from the support facilities site until FDR No. 150 had been relocated and a parking lot at the waste water treatment plant had been constructed. A parking lot capable of handling the parking needs of the largest shift plus visitors to the mine, estimated at 150 to 175 vehicles, would be necessary (see Figure 2-38). Busing employees would then continue from this location and would reduce the mine construction- and operation-related traffic to primarily supply vehicles, mine management vehicles, and two or three buses twice per shift including the administrative workers shift.

A portion of FDR No. 150B may be removed and reclaimed after the tailings paste facility has been reclaimed and the paste treatment plant decommissioned, removed, and reclaimed. The need for closure, reclamation, or modification of Forest System roads used by Sterling during mine operation to gravel or dirt roads would be determined by the KNF at mine closure. The post-mining treatment of roads would depend on forest land uses, needed road densities, and KNF's ability to maintain paved roads versus gravel or dirt roads. Road closures are described in the Threatened and Endangered Species Mitigation plan for this alternative.

[15] Mine related construction traffic would be limited to 30 roundtrips per month on FDR No. 150B between April 1 and July 31 and unlimited traffic from August 1 to March 31.

Utilities

Evaluation Adit Electrical Supplies. Alternative V replaces the diesel generators with two propane-fired generators (545 kW and 735 kW). The support facilities would be supplied with power from a local distribution line along Government Mountain Road as described for Alternatives II through IV.

Pipelines. A single utility corridor would be developed along FDR No. 150 and would include the transmission powerline, a tailings slurry pipeline, ore concentrate pipeline, mine discharge pipeline, and return water pipeline (see Figure 2-29). The pipelines would split into two corridors at the junction of FDR Nos. 150 and 150B. The tailings slurry pipeline and concentrate pipeline and a return water line would follow or parallel the FDR No.150B road alignment to the paste plant. The concentrate pipeline and return water line would continue along FDR No. 150B and a short stretch of the Government Mountain Road to the rail loadout facility. The mine water discharge line and a return reclaim water line would follow the new FDR No. 150 alignment to the waste water treatment plant and the discharge line would continue to the discharge outfall in the Clark Fork River and connect with the make-up water well located adjacent to the river. See Table 2-17 for information on the size and types of pipe proposed for use. All pipelines would be buried at least 24 inches deep. Burying the pipelines would provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the paste plant. The pipelines would be visible at the four above ground crossings of Rock Creek, West Fork of Rock Creek, and Engle Creek. All lines would be encased in a larger steel pipe at creek crossings adjacent to or near bridge crossings to guard against the unlikely event of a leak or rupture.

Powerlines. Sterling would construct 5.3 miles of 230 kV transmission line with 61-foot-high wooden utility poles, dark porcelain or polymer insulators, and nonspecular conductors to reduce contrast within a 100-foot right-of-way. The transmission line would parallel the new FDR No. 150 until it intersected existing FDR No. 150 and then continue to parallel the existing FDR No. 150 from a new switchyard on an existing 230 kV line near Montana Highway 200 to the mill as described for Alternatives III and IV. Sterling would construct the new switchyard adjacent to the existing Noxon/Libby 230 kV line near Montana Highway 200 in a dedicated power line right-of-way. Two new substations at the mill and in the tailings storage facility area would be constructed as for Alternatives II through IV:

- one substation would be constructed at the mill site to distribute electricity through lower voltage lines to equipment within the mill site, adit, and mine; and
- a second substation would be constructed near FDR No. 150 in the vicinity of the tailings paste facility for electrical distribution to that area. This would involve clearing a 100 by 100 foot area and fencing it.

The rail loadout facility would be supplied power from a local distribution line along Government Mountain Road. Sterling would be responsible for paying all construction costs for the substations and transmission line. Annual power consumption is estimated at 95,000,000 kW-hours, with a peak demand of 13,300 kW. No power provider has been selected for supplying the mine's estimated annual consumption of 95,000,000 kW-hours.

TABLE 2-17
Summary of Pipeline Information for Alternative V

Pipeline	Location	Size	Type
Tailings Slurry Pipeline	Mill to paste plant	16 to 24 inches(1)	Steel/polyethylene dual-wall pipe w/leak detection
Reclaim water return pipeline	Paste plant to mill	16 inches	Dual-wall pipe w/leak detection(2)
Mine water discharge pipeline/make-up water pipeline(3)	Mine to waste water treatment plant to Clark Fork river diffuser	12 to 14 inches	Single-walled pipe w/leak detection
Mine segregation water pipeline (option for later development)	Mine to waste water treatment plant	10 inches	Type undetermined at this time
Concentrate pipeline	Mill to rail loadout facility	3 inches	Dual-wall pipe w/leak detection(2)
Concentrate return water line	Rail siding to paste plant	2 inches	Dual-wall pipe w/leak detection(2)
Storm water return pipeline	Paste facility site storm water retention pond to paste plant	6 inches	Single-walled pipe w/leak detection

Source: Hydrometrics 1997a

Notes: (1) The final pipeline diameter will need to be determined based on tailings viscosity and topographic analysis of final pipeline corridor.
(2) The type of dual wall pipe has not been determined at this time.
(3) Mine water is estimated to meet mill make-up water requirements; however, a contingency make-up water well site has been identified near the Clark Fork River in the event that insufficient mine water is available. In this event, make-up water would utilize the discharge pipeline.

Utility corridor right-of-way clearing. Sterling would use the following measures to reduce right-of way clearing and help produce a feathered, more natural-appearing edge of timber along the utility and road corridor. These measures would be applied to appropriate segments of the corridor during the design phase:

- retaining non-hazardous trees and brush on the right-of-way;
- cutting trees at ground level to reduce visibility of stumps;
- disposing of felled material with the least possible impact on remaining vegetation; and
- selective clearing of timber adjacent to the corridor to soften the edge between cleared and uncleared areas.

Erosion and Sediment Control

Wind and water erosion control measures are described in detail throughout Sterling's permit application in operation and reclamation plans. These measures involve 1) mechanical practices to minimize fugitive dust, 2) grading to reduce erosion potential, 3) soil-handling techniques to enhance stability, 4) hydrologic systems to control runoff and sedimentation, and 5) revegetation practices to provide a stabilizing cover. Sterling would follow Forest Service soil and water conservation practices. A storm water discharge permit may be required from DEQ. As part of this permit or the MPDES permit, Sterling would be required to submit a storm water management plan for DEQ approval. This plan would describe the methods to minimize and control runoff contamination.

Sterling would be required to implement all BMPs detailed in its permit application and described under Alternative II. In addition, a vegetation management plan would be developed by Sterling and approved by the Agencies to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments. A field review would be required by agency hydrologists/soil scientists after facilities and roads have been staked in the field but before construction begins to identify any additional BMPs needed on a site-specific basis.

Sterling would mitigate for unavoidable fine sediment impacts to Rock Creek resulting from the construction of facilities and changes in the road system. Sediment mitigation measures would consist of stabilization, armoring and revegetation of existing sediment sources in the Rock Creek floodplain, and maintenance of these measures for the term of the project. Concurrent with project start-up, Sterling would mitigate an eroding cutbank where Engle Creek joins Rock Creek (site P1). Also beginning in year 1, Sterling would inventory the Orr Creek and Snort Creek basins to identify potential sediment mitigation opportunities and estimate the annual fine sediment production in tons/year for all identified floodplain sediment sources in the watershed. Sterling would submit a fine sediment mitigation plan to the Agencies for approval, and cumulatively reduce the annual fine sediment loading to Rock Creek by at least 400 tons by mitigating two or more sediment sources in the west fork basin and in the mainstem floodplain of Rock Creek prior to the end of the project construction period. Treated mitigation sites would be monitored in average to above-average snowpack years (as of April 15), or in the event of greater than bankfull discharge events. This monitoring would be needed to measure erosion of the treated sites and to quantify any need for further mitigation that would maintain the 400 ton fine sediment reduction and ensure effectiveness of the mitigation program for the life of the project.

Employment

The development schedule and employment levels during all phases of the project would be the same as described for Alternative IV. Development of the evaluation adit would take about a year. Work would start with 23 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction might immediately follow the adit work, or there could be a period of inactivity lasting months or even years between the two phases.

During the initial phase of mine construction, the entire workforce would consist of 73 Sterling employees, then 275 contract construction personnel would be brought onto the project for 18 months. Employment of Sterling and contract workers would peak at a total of 348 during mine construction, with the minimum employment of 180 mine workers following this peak at about year four of construction. Sterling would have no direct control over contract labor schedules. It is expected that the contractor would use a 7-day work week with more than one shift per day.

As contract construction ended, the Sterling workforce would be expanded to 180 workers, from where it would continue to increase to 340 permanent full time workers nearly 2 years later as the mine reached full production. The project would operate 24 hours per day, 7 days a week, 354 days a year. It would have an expected operating life of up to 30 years. At the end of production there would be a two-year shutdown and reclamation period employing 35 workers. Because the available labor force initially would not have all the skills needed to develop and operate the mine, Sterling proposes to conduct an intensive training program.

Adit Closure

The adit closure plans for the air-intake ventilation and evaluation adits would be the same as described in Alternatives III and IV.

The evaluation adit would be plugged with reinforced concrete at mine closure. Since this adit would be a decline and the portal is above the water table, the purpose of the plug would be primarily to close off access and eliminate any potential for surface water inflow.

Closure of the main access adits would depend upon what impacts if any occur to the wilderness lakes above the mine and the potential for creation of springs and seeps down gradient of the mine workings. If the mine had an impact on the groundwater recharge of the wilderness lakes and the buffer zones at the ore outcrops was sufficient to prevent springs and seeps then the mine would be sealed and flooded. If despite the ore outcrop buffer zones, the potential for the creation of springs and seeps existed as determined by data collected during mine operation, then the mine adits would not be sealed but only closed to prevent access. In this case, the discharge would continue to be pumped in perpetuity down to the waste water treatment plant until it met the MPDES discharge limits without treatment and then would be discharged without treatment into the Clark Fork River.

If there were no impacts either to the lakes or the potential for creation of new springs and seeps was negligible, or if there were impacts to the wilderness lakes that needed to be reduced, then the main access adits would be sealed once mine water met ground water standards without treatment. Under these scenarios the service and conveyor adits would be plugged with reinforced concrete near the elevation of the orebody within the mine. This would prevent 1,150 feet of water pressure that would develop if adit seals or plugs were only placed at lower elevations in the adits. The adits would be closed at the portal with non-mineralized waste rock to prevent access. Drainage from the portal (inflow to the adits below the elevation of the plugs) would be treated and discharged to the Clark Fork River until it met applicable surface water quality standards without treatment at which time it would be allowed to infiltrate into the reclaimed mill pad and underlying alluvium. Monitoring data would be used to establish discharge requirements prior to the time of adit closure.

The wilderness air intake ventilation adit would be reclaimed. Sterling would develop a plan to restore the air intake ventilation adit within the CMW to its premining appearance and configuration following mine closure. The grate and fan would be removed internally and the adit would be sealed with a 12-inch-thick bulkhead. The bulkhead would be constructed from within the adit using reinforced concrete. Equipment removal and plugging would be conducted primarily from inside the adit. Rock from adjacent areas and/or waste rock treated with oxidating compounds would be used for the surface closure to replicate natural conditions and appearances. Sterling would investigate the potential for creating bat habitat at both the evaluation and air-intake ventilation adits. Depending upon the results of the study, agencies may require modification to adit closure plans to accommodate bats.

The adit closure plan would need to be finalized and submitted to the agencies for review and approval prior to mine closure.

Reclamation

Reclamation of the evaluation disturbances, adits, mill site and utility corridors would remain the same as described for Alternatives III and/or IV, depending upon the facility in question. The revegetation plan is summarized and seed mixes are described in Appendix J. An updated, detailed reclamation plan[16] that covered revegetation of all mine facilities would need to be submitted for Agency review and approval before mine construction. The plan would provide the means to ensure adequate reclamation and minimize visual impacts of the project. Plans for reclaiming any Forest System roads, if required, would be submitted to the Forest Service for review and approval.

Reclamation objectives remain the same as described under Alternative II. Short-term reclamation objectives are to stabilize disturbed areas and to prevent air and water pollution. The long-term reclamation objective is to establish a postoperational environment compatible with existing land uses and consistent with the Forest Plan. Specific reclamation objectives include the following:

- permanent protection for air, surface water, and ground water resources;
- protection of public health and safety by removing potential hazards;
- maintenance of public access through the project area;
- restoration of wildlife habitat;
- design of a land configuration compatible with the watershed;
- re-establishment of an aesthetic environment allowing for visual quality and recreational opportunity; and
- re-establishment of postoperational biological potential suitable for supporting vegetative cover appropriate to the area.

To accomplish these objectives, Sterling proposes to provide interim revegetation and stabilization of most disturbed areas, to follow measures described under Sediment and Erosion Control, and, after mining, to reclaim all disturbed areas by recontouring and redistributing soil, and revegetating.

Postmining Topography. All buildings and other structures at the evaluation adit support facilities site would be removed once the mill site was operational. It is estimated that the support facilities would be used through exploration and the first 3 to 4 years of mine construction and operation. This site would be either recontoured to approximate original contours or otherwise developed for facilities associated with the operation of the tailings paste facility.

Sterling would regrade the evaluation adit waste rock dump to approximate existing contours at the end of operations, eliminating any bench at the adit portal. Waste rock from the lower Revett Formation,[17] a rock formation with similar characteristics to surface rock, would be used for the surface layer of the dump, especially for the portion that would be left unvegetated. If necessary to meet visual quality objectives, waste rock surfaces that remained exposed after reclamation would be treated with oxidizing compounds to blend them with adjacent talus (Reynolds 1995). Where possible, existing trees

[16] This primarily entails incorporating the additional agency requirements into the revegetation plans for all mine facilities that are contained in Sterling's permit applications and submitting them to the Agencies to verify that all requirements have been added and to approve the plans if acceptable.

[17] This rock type would be the last waste rock removed from the evaluation adit. Due to variations in rock types within the formation, it may be necessary to stockpile quartzite material that closely resembles surface talus to blend the new rock dump with the existing talus as much as possible. This material would be stockpiled on the bench or stored in the adit until ready for deposition as the final layer on the rock dump.

at the outer edge of this talus slope and existing pockets of trees and shrubs within this talus slope would be retained and would not be damaged during dumping. Reclamation of the evaluation adit portal would be the same as described for Alternative II. If stockpiled ore at the evaluation adit proved uneconomical to process, Sterling would develop a plan, subject to review and approval by the Agencies, to dispose of the ore in conjunction with reclamation of the evaluation adit.

A channel would be constructed across the evaluation adit waste rock dump from the area of the backfilled lined pond to the access road cut to connect natural drainage areas above and below the evaluation adit dump. This channel would be lined with coarse rock to prevent erosion. Disturbances other than the evaluation adit waste rock dump (i.e., facilities area, diversion ditches, fuel storage area) would be graded to blend with adjacent undisturbed topography.

Sterling would be required to submit more detailed design and regrading plans for all mine facilities for Agencies' approval in conjunction with the final design of the paste facility. Landform design for the tailings paste facility would incorporate topographic templates from the surrounding area to help meet reclamation goals and Forest Service visual standards. These plans would result in reclaimed sites that decrease landform and vegetation differences between mine facilities and surrounding natural landscapes.

The diversion structures above the reclaimed tailings facility would remain as permanent stream channels to route runoff around the reclaimed tailings mass. All mechanical facilities associated with the tailings facility would be removed. The remaining surface disturbances (e.g., runoff control ditches, seepage capture and storm water ponds, facility pads, soil stockpile sites, emergency dump ponds, and internal and perimeter access roads) would be returned to approximate original contours.

After mining and ore processing were completed, all mill buildings and related equipment and infrastructure, the conveyor, and the power line would be dismantled and removed. Paving material would be buried on site or removed to a disposal facility. Inert waste such as steel, concrete, plastic, or wood would be buried in on-site waste disposal areas or sold to scrap dealers for recycling; some waste may be transported to an approved waste transfer station as authorized by the county solid waste district. Buried pipelines would remain in place except at stream crossings.

Once ground water quality beneath the tailings facility met ground water quality standards and MPDES limits without treatment, and Sterling was given permission to shut down the seepage collection system, all remaining tailings facility-related surface components would be removed, and the sites regraded according to approved plans. Wells would be decommissioned once monitoring was no longer required or the well was no longer required (i.e., a contingency pumpback well used to control seepage when control was no longer a need). When the waste water treatment facility would not be needed for treating tailings seepage and/or mine adit discharge, the buildings, related equipment, and surface discharge pipelines would be removed and the sites regraded to approximate original contours.

Final reclamation of portions of mine facilities, such as outer slopes of the mill site pad and completed portions of the tailings paste facility would be done as early as possible to assist in decreasing the visual impact of the project. Toe buttresses and paste layers creating the deposit surfaces for all options, and the compacted paste zone of the Bottom-Up option, would be designed to minimize straight horizontal crests, long linear contours and uniformly sloping surfaces; however, stability requirements would have precedence. Contours of reclaimed surfaces, including those on the top surface of the deposit, would mimic those of surrounding topography. Both regrading and selective placement of the paste during deposition would be used to create topographic pockets, swales, ridges and surface water drainages. Rocky soils and possibly cement additive would be used in steepened drainageways to create naturalized swales and help break up the massiveness of the deposit.

Vegetation Removal and Disposition. The mining company must prepare a Vegetation Removal and Disposition Plan that deals with the potential uses of vegetation removed from areas to be disturbed. The plan must detail disposition and storage plans during mine life. The vegetation debris piles and surface lift soil piles containing large quantities of organic debris should be stored in carefully selected storage sites to prevent off-site impacts from the production of low quality organic acids as the materials begin to decay.

Where possible, slash from timber-clearing operations would be salvaged for soil protection. Large or whole pieces could be used as physical barriers and catchments and ground-up slash would be used as mulch or as an additive to stored topsoil. Large or whole pieces could also be used to enhance or create desirable fisheries habitat in Rock Creek according to aquatic/fisheries mitigation plans. All mulching materials would be certified weed-seed free.

Soil Salvage and Handling Plan. Direct haul soil salvage and replacement would be required as much as possible to enhance revegetation success of native unseeded species. Most soil would have to be stockpiled. Areas such as road cut-and-fill slopes, power line pole locations and access roads, and other disturbances that would remain postmine should be reclaimed as soon as final grades are achieved with direct haul soil or soil that has been stockpiled for less than one year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface.

Soil stockpiles would be constructed with a 2.5:1 side slope and 3:1 ramps. Soil stockpiles would be incrementally stabilized (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Soil stockpiles would have organic matter added to help retain soil quality. Seeding would be done as soon after disturbance as possible rather than waiting until the next appropriate season. Fertilizer and mulch would be applied to the piles as necessary. Sediment traps would be used downslope where necessary to minimize soil movement.

In forested soils, it is advantageous to stockpile the surface organic and mineral horizons and store them separately from subsoil mineral horizons. Ideally, this would mean that the surface 6-12 inches of organic materials and soil would be separated from the subsurface 12-18 inches of soil in a 24 inch soil replacement profile. To pick up a uniform 6-12 inch organic and mineral layer in a forested setting is not practicable. Soil would be salvaged in a two-lift process with the first lift being the more suitable topsoil and the second lift being subsoils excavated up to 36 inches; average total salvage depth equaling 24 inches. Replaced soil depths would average 24 inches over the tailings paste facility, the mill site, and the waste water treatment facility site. If extra soil is available at the mill site, it should be stockpiled for use at the paste facility or other locations. DEQ requires salvage of rocky soil (less than 50 percent rock fragments) if it is characteristic of the area. Shallow and rocky soils would be salvaged at the evaluation adit and at the mine portal if present. Sterling would be required to submit a revised soil salvage and handling program that deals with two lift salvage and storage practices and concerns over water quality, and direct haul soil replacement on acreages reclaimed during mine life.

Soils salvaged from 7.7 acres at the evaluation adit site would be removed in two lifts where soil was available and where slopes were less than 2:1. The soil would be stockpiled northwest of the evaluation adit (see Figure 2-26). All of the first lift soil and half of the second lift soil would be redistributed over 5.0 acres at the adit, waste rock dump top, and facilities to an average total depth of 12 inches. The remaining second lift soils would be redistributed over a portion of the slope face of the dump designated for revegetation at an average depth of 13 inches over 1.9 acres. Approximately 1.4 acres on the waste rock dump would be left as talus to achieve a mosaic appearance.

Because the paste would be deposited layer upon layer, soil would be stripped just ahead of the extent of the proposed disturbance for each layer. The first soil stripped for the first two or three layers would need to be stockpiled for reclaiming the final segment and outer slope. At times soil being salvaged may not be suitable for the portions of the facility that need to be reclaimed; this soil would also be stockpiled until needed for other purposes. The soils would be segregated according to rocky or non-rocky soils and first lift versus second lift and, if necessary, stockpiled adjacent to the deposit site (see Figure 2-26). Sufficient volumes of the colluvial and alluvial soils, including their rocky subsoils, within the tailings paste facility footprint would need to be salvaged and stored for use in reclaiming slopes 8 percent or greater and along reconstructed drainage ways to minimize erosion. Based on experience and preliminary research to control erosion at Golden Sunlight Mines, the lacustrine soils could be mixed with the rocky subsoils or crushed bedrock to produce a soil with 20% rocks greater than 1 inch in diameter. The mixed soil must also have less than 20% very fine sand in the fine soil matrix (Golden Sunlight Mines 1995). The lacustrine soils could be placed on all slopes less than 8 percent (approximately 12.5:1) without the addition of rock materials as long as the slope length is limited by armored drainageways or other erosion control features. Soil would be salvaged in a two-lift process with the first lift being the more suitable topsoil and the second lift being subsoils excavated up to 36 inches; average total salvage depth equaling 24 inches. Replaced soil depths would average 24 inches over the tailings paste facility. The final design of the paste facility would need to include a volume determination of soil types needed based on the slope breakdown of the paste facility.

Sterling would need to conduct a more detailed soil survey to more accurately determine the amounts and types of soils available for reclamation prior to construction of the paste facility and associated facilities. Since rocky materials are also needed for constructing the toe buttresses, the survey is especially important to ensure there is enough material available for both requirements or to identify the need to obtain more rocky material from other sources than has been estimated in Table 2-13.

The tailings paste could, if needed, have organic amendments or fertilizer added to the uppermost lift. This material, which would have no cement added, may need to be ripped prior to topsoil replacement to minimize the development of a root-barrier zone. Both regrading this material and selective placement of the paste during deposition would be used to create diverse topographic pockets, swales, ridges and surface water drainages constructed to a predetermined surveyed gradient in the final design. Overall outer slopes would range between 2H:1V and 5H:1V. These slopes would be protected against erosion using BMPs described in detail for Alternative II and in the Erosion and Sediment Control section above. The compacted slopes of the Bottom-Up or Combined option would have less potential for slope variability due to the method of construction and would have a general appearance similar to that of a conventional tailings impoundment. The flatter slopes of the Top-Down option appear to offer greater flexibility to develop a more natural appearing landform.

Disturbed areas, especially parking lots, roads, and building sites, would be ripped prior to soil replacement to reduce any root zone barriers due to compaction and to facilitate storm water infiltration after reclamation. Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding for best seed establishment. Where soil fertility may be low and tilth poor, organic matter (weed-free aged manure, compost) would be incorporated into respread soils before planting.

Revegetation. Sterling would develop a detailed final planting design[18] for all disturbed areas including the area between the impoundment footprint and the highway. Final designs would avoid uniform distributions of plants, with planting densities, species selection, and their distributions repeating natural patterns in the surrounding landscape. A combination of planting designs, natural mortality, and possible thinning of thick tree stands would achieve a natural-appearing mosaic of vegetation on reclaimed areas. Forest Service standards for revegetation would be required on NFS lands.

Sterling proposes to meet short- and long-term objectives stated in its revegetation plan. The plan specifically addresses species selection for final and interim seed mixtures and planting schemes, seeding and planting rates, seedbed preparation, seeding and planting methods, cultural treatments, and interim revegetation. The proposed seeding and planting mixes are presented in Appendix J of the final EIS and the applicant's proposed reclamation plan (ASARCO Incorporated 1987-1997). Weed seed-free seed mixes would be modified to include grass and forb species suited for quick stabilization as well as those needed for long-term wildlife habitat needs. Locally collected seeds and plants would be used whenever possible.

The proposed species selection and seeding/planting rates are based on preoperation vegetation types, environmental tolerance, species that exhibit hardiness on postoperational sites, and a variety of other factors. An understory seed mix consisting of grasses and forbs would be used on all disturbance areas. Shrubs would be seeded on most sites, but not on the evaluation adit site or the transportation and utility corridors.

Grass species proposed, including both native (preferred) and non-natives (where other options are not feasible), are typical of those used for reclaiming sites in similar settings. Forbs and shrubs proposed are native species that typically occur in one or more of the communities identified within the project area. No clovers would be planted on any disturbed areas during mine operation, as clover is a bear attractant. No cereal grains are to be added to the seed mixes. Seed mixtures may be modified due to limited species availability, poor initial performance, advances in reclamation technology, or a variety of other factors.

Seeding rates would average about 120 pure live seeds per square foot (13 to 16 pounds per acre) for drill seeding and roughly twice that for broadcast seeding. Drill seeding would occur on slopes of less than 3:1 (horizontal to vertical) that are not rocky as determined by the Agencies. Steeper slopes and rocky areas would be broadcast or hydroseeded (a technique where seed is mixed into a slurry and sprayed onto a slope). Seeding would occur in the first appropriate season following site preparation.

Sterling proposes a number of cultural treatments for seedbed preparation. Sites would be prepared for seeding by grading; ripping to prepare the surface for soil placement; respreading salvaged soil; and tilling soils on gentle slopes (3:1 or less) to break up clods and relieve compaction, as needed. Phosphorus fertilizer, important for seedling establishment, would be applied prior to seeding. Once seeding occurred, straw mulch would be applied and anchored according to slope steepness and seeding method. Nitrogen fertilizer would be applied early in the subsequent growing season to enhance growth.

[18] This primarily entails incorporating the additional agency requirements into the revegetation and reclamation plans for all mine facilities that are contained in Sterling's permit applications and submitting them to the Agencies to verify that all requirements have been added and to approve the plans if acceptable.

Successful establishment and growth of trees are necessary to obtain the greatest visual mitigating effects on and adjacent to mine facilities. Given the importance of mycorrizhal fungi for tree growth and establishment, Sterling would obtain locally grown tree seedlings from an appropriately inoculated soil medium. Legume species would be inoculated with appropriate nitrogen-fixing bacteria. Other methods such as transplanting native shrubs and/or very small trees could be proposed. Fertilizer requirements and planned fertilizer applications would be carefully calculated to minimize nutrient losses due to deep leaching.

Shade cards or other methods would be used to protect tree and shrub seedlings, especially on south- and west-facing slopes of the impoundment and mill site. New tree and shrub plantings would be protected from wildlife browsing by netting. Drip-irrigation would be used during April through early June for up to three years after planting trees and shrubs on the tailings paste facility face to help with plant establishment.

Trees would be planted on slopes that do not exceed 3:1 in the tailings impoundment area, the facilities area, the waste rock dump top, and the access road to the waste rock dump. Trees would be planted in 2-to-4-foot-wide strips alternating with 8-foot-wide strips that were drill seeded. Trees would be planted 6 feet apart to achieve an initial stocking rate of 663 trees/acre. Planting patterns would be modified as needed to better mimic natural vegetation patterns on adjacent undisturbed lands. Reforestation of the transportation corridor and the evaluation adit area would rely on natural regeneration. Shrubs would also be planted on the tailings facility face. Shrubs would be planted on the access road cuts, only if herbaceous vegetation was not providing adequate erosion control.

During mine life, Sterling would also reclaim all cut-and-fill slopes along the access roads, and the adit portal slopes to maximize native plant establishment and minimize erosion, weed invasion and visual impacts during mine life. Interim reclamation plans would be developed with agency reclamation specialists to reduce slopes if practicable to approximate postmine contours wherever possible. Slopes reclaimed during operations would be revegetated with the permanent seed mix and planted as per the approved plan. This aggressive reclamation program is designed to increase native plant establishment, increase sediment and erosion control, limit noxious weed invasion, and reduce visual impacts during mine life.

Throughout mine life, disturbances would be seeded as they occurred with the permanent seed mix. Final revegetation (seeding) would occur in some areas during the preoperational phase; others would be revegetated incrementally when possible, such as the tailings paste facility. Final revegetation of all other disturbances not previously reclaimed would be completed within 2 years after mining.

Sterling would finalize a detailed planting plan for the mill site. Final revegetation of pad faces would occur as soon as the pad was completed. It would be seeded with grasses and forbs and planted with containerized shrubs and trees. Plantings would mimic natural patterns of vegetation.

Reclamation of the tailings paste facility would be somewhat different from that of a traditional tailings impoundment. Concurrent topsoiling and reclamation would allow the portion of the top and outer slopes of the paste facility that had achieved final grade to be reclaimed while the next segment was constructed. However, the timing of final reclamation would vary somewhat depending upon which option is selected. Final reclamation of the Bottom-Up option would occur on an annual basis unless specified otherwise by the Agencies. Reclamation of a small portion of the Top-Down option could begin in year 7 of mine operation (see Table 2-14) and could only be done when the layers had reached their maximum height as each succeeding paste layer would cover the preceding layer. The sides and top of the Top-Down option could still be reclaimed concurrently with the stripping of soil from the next area proposed for disturbance rather than waiting until the facility was completely constructed. Reclamation of the Combined option would depend upon which method was being used at the time.

Interim revegetation would occur on an on-going basis for all paste options. An interim seed mix would be added to the paste before its deposition to limit erosion off paste slopes during operations and to reduce aesthetic impacts. A color tackifier or hydroseeding would also be applied to deposit lifts as needed for interim reclamation and stabilization prior to initiation of final reclamation activities. Both toe buttresses and paste deposit slopes for any of the deposition options would be seeded annually with final revegetation mix on any portion that reaches final grade.

Trees would be planted on each segment as it was reclaimed and seeded with approved planting mixes of grasses, forbs, and shrubs. The applicant has planted trees for screening between the main powerline and Montana Highway 200; however, the planting would be inspected during evaluation activities and any dead, dying or missing trees would be replaced to achieve the required density.

Sludge would be removed from the aeration pond after the water treatment system was decommissioned and dismantled, dried, and enclosed in a geomembrane lined cell in the impoundment. The substrate would be buried in the impoundment under a graded compacted layer of at least 6 feet of tailings near the embankment face. Topography in the area of the sludge would be mounded to prevent excess water from potentially moving through the substrate.

Reclamation of the mounded tailings over the aeration pond slurry cell substrate would be completed by applying a minimum of 24 inches of soil, followed by revegetation. The pond would be backfilled with clean subsoils to a mounded configuration to produce an area which would limit infiltration through the old pond area. Then the mounded subsoil area would be covered with a surface lift of soil and revegetated. Bond would be calculated to cover this reclamation modification and would include the salvage and storage of the materials needed to complete the reclamation at mine closure.

At the end of mine life agency reclamation personnel would review the reclamation success on the slopes and decide if the successful portions with up to 20-30 years of vegetation growth could be left in the final reclamation plan. Portions with unsuccessful reclamation would be recontoured as per the reclamation plan and soiled or rocked accordingly.

Pipeline Corridor Reclamation. The pipeline would be built and installed and covered with at least 24 inches of soil that had been salvaged prior to construction. No trees or shrubs would be seeded along the pipeline corridor, but any trees or shrubs that volunteered would be left. Trees that encroached on powerline conductors or were in the way of maintenance vehicles would be removed. Maintenance or replacement of a pipeline liner would require some redisturbance of a small area that would be immediately reclaimed after the work was done. When the pipelines were no longer needed they would be removed for a distance of 15 to 20 feet from stream crossings and where the pipes surfaced at the mill, the paste plant, the waste water treatment facility, and the Clark Fork River. The pipes would be completely drained, capped, sealed, the ends reburied, and the redisturbed section regraded, stabilized if necessary, and revegetated. The remaining buried segments of the pipeline would remain in place.

Monitoring and Mitigation Plans

Sterling would be required to submit for Agency review and approval the monitoring and mitigations plans described for Alternatives III and IV. These plans include: rock mechanics monitoring, water resources monitoring, wildlife monitoring, aquatics and fisheries monitoring, reclamation monitoring and several mitigation plans. Additional or modified plans were also developed for Alternative V and these plans are also subject to agency review and approval. All monitoring and mitigation plans are briefly described below. See Appendix K for more details of the monitoring plans. Plans with an "*" next to them contain some component(s) that would be required during evaluation adit construction.

Air Quality Monitoring. Sterling would be required to monitor air quality around the operation as part of its air quality permit. The specifics of the monitoring plan would be reviewed annually. The purpose of the plan would be to evaluate the effectiveness of implemented air pollution control technologies.

Rock Mechanics Monitoring*. Sterling would submit a separate surface and underground monitoring and testing plan once underground development had progressed enough to establish monitoring points. Its purpose would be to define the existing geologic stress field and its response to underground mining. The plan would specify monitoring equipment, locations, and frequency of monitoring and reporting, and define types of laboratory tests and frequency of testing. The information would be used in planning the exact size and location of underground openings and support pillars, identifying locations needing additional support and areas to be avoided for final mine development, and for making predictions about long-term behavior of the underground rock mass. Once mining was underway, Sterling would be required to submit detailed mine development plans in advance of entering areas of suspected rock instability as identified in the preliminary design and during the underground monitoring program. These reviews could result in Sterling leaving more in-place ore for support than was originally intended, or conversely the information could suggest areas where pillars could be removed without jeopardizing the long-term stability of the site.

Acid Rock Drainage and Metals Leaching Plan*. Alternative V incorporates recommendations from a third-party technical analysis and risk assessment (Failure Modes Effects Analysis) that evaluated geochemistry data that relates to the Rock Creek Project (Klohn-Crippen 1998). The Acid Rock Drainage and Metals Leaching Plan, located in Appendix K, would include additional geochemical testing as recommended by Klohn- Crippen for the Rock Creek evaluation adit, mine operations and the Troy Mine. This testing would provide for static testing of Rock Creek and Troy Mine representative ore, waste rock (for constructing the mill site, paste facility buttress, and crushed rock around finger drains beneath the paste landfill) and Rock Creek/Troy Mine tailings. Kinetic testing would verify metal dissolution/sulfide oxidation and metal leaching processes as indicated by static testing for all waste rock and tailings. Mitigations based on testing results are discussed. Premature shutdown considerations for waste rock and tailings testing results are also included. For further discussion regarding monitoring or water quality impacts from waste rock and tailings, please refer to the Water Resources Monitoring Plan described briefly below and in more detail in Appendix K. Monitoring requirements are also set forth in the MPDES permit statement of basis in Appendix D.

The agencies would require that waste rock used for construction of the mill site, paste facility buttress and around the finger drains beneath the paste landfill be thoroughly tested, including long term geochemical testing as waste rock is generated. Waste rock would be generated during adit excavations.

Evaluation adit waste rock would be stored adjacent to the portal. Waste rock from the twin mine adits (access adits) would be used in the tailings retaining structures and the mill pad. Evaluation adit waste rock would be produced for at least one year before construction of the twin production adits (which provide facility construction rock) would begin. Once mining begins, waste rock would be placed underground in mined out areas. Mineralized waste rock would be placed underground or encapsulated in the paste facility to minimize the potential for acid rock drainage or metals leaching. However, mineralized waste rock at the evaluation adit may be encapsulated in place if it could not be hauled into the mine or down to the paste facility.

Evaluation Adit Data Evaluation Plan*. Data would be collected during construction of the evaluation adit. The conceptual plan is described in more detail in Appendix K and contains components of the Acid Rock Drainage and Metals Leaching Plan (see previous paragraph), and the Rock-Mechanics Monitoring Plan (see Alternative III description). The evaluation adit data would be compared to the data used in analyses in the final EIS to verify the analyses. The data would be used to improve and modify various plans and designs such as the waste water treatment systems, water handling plans, waste rock handling, the tailings paste facility construction methods, and mine design and operation. Plans would be modified, if necessary, through the permit revision process that includes some level of MEPA/NEPA analysis so that the environmental impacts would be no greater than disclosed in Chapter 4 of this EIS for Alternative V. If that could not be achieved, then the permit and the change in proposed impacts would be subject to the appropriate level of MEPA/NEPA analysis and public comment and review. The construction of the mine and mill facilities could not begin until the agencies had reviewed the data and any modified plans and designs and conducted any required MEPA/NEPA analyses.

Tailings Paste Facility and Tailings Slurry Line Construction and Operation Monitoring Plan. The intent of the construction monitoring plan for the tailings paste facility and associated tailings slurry lines would be to establish standard of care construction implementation, testing, and reporting guidelines. The plan would outline construction QA/QC protocols to ensure that any constructed facility was being constructed to the design and performance standards set forth in the application and the design documents. Prior to construction Sterling would submit a construction monitoring plan to the Agencies for approval. The construction monitoring plan for the tailings paste facility and the tailings slurry line is divided into four discrete time segments. The four time segments are as follows:

- Final Design Phase: Agency review and approval of final designs for tailing paste facility, paste plant, tailings slurry lines, and emergency dump ponds.
- Preproduction Construction Phase: Standard inspection and quality control procedures would be implemented with periodic interim construction reports submitted at 2-month intervals during construction of toe buttresses. A final construction report would be submitted prior to operation. This report would contain as-built drawings.
- Operational Phase: Monitoring would continue throughout project life and would include routine inspections and reports of facility geometry, material specification, embankment drainage, foundation pore pressure, and observational performance.
- Interim Facility Shutdown: In the unlikely event of a shutdown, the tailings facility monitoring plan would be continued.

Water Treatment Plant Construction and Operation Monitoring Plans. The intent of the water treatment construction and operation monitoring plan is to establish QA/QC practices and operational standards for the water treatment plant and associated activities. The operating plan will include operating protocols, water quality treatment standards, and contingency plans for system upset or malfunction. These plans would be submitted to the Agencies for approval prior to plant construction.

Mine, Mill and Associated Facilities Construction and Operation Monitoring Plans. All mine and mill facilities will have construction and operation monitoring plans. These plans will outline standard of care construction practices for these facilities, and will include information of testing, monitoring, and reporting. The site location of certain facilities may encroach on sensitive habitat, and construction practices will be clearly defined in regards to building in these areas so as to minimize impacts.

The intent of the operation monitoring plans is to establish protocols for the operation of all facilities to ensure standardized performance. The operating plans will address daily operations, contingency plans, system upsets and performance criteria. The plans will be submitted to the Agencies for approval prior to construction.

Reclamation Monitoring Plan*. Revegetated areas would be field checked during the first season following revegetation and annually throughout mine life to determine success. Monitoring would include qualitative evaluation of cover, species composition, and tree planting success. If problem areas were identified, remedial action would be taken. Evaluation of site-specific reclamation would also be conducted on rights-of-way, the tailings facility outer slopes, and the evaluation adit waste rock dump. Evaluation parameters would include species response, soil distribution depth, planting techniques, effects of fertilizer rates, and reclamation success on steep, rocky slopes.

Sterling would be required to finalize a detailed reclamation monitoring plan, subject to agency approval, that would address reclamation/soil stability during mine life as well as after closure. An approved monitoring schedule would be developed for the tailings storage facility during the final design phase. Since establishment of trees takes 5 to 7 years at a minimum, Sterling would carry out a long-term monitoring program for up to 20 years after mine closure. Specific measures would include:

- monitoring soil salvage and replacement to verify depth and suitability;
- inspecting for erosion in spring and fall and after heavy rain and implementing immediate erosion-control measures, including structural measures and other BMPs, if necessary to control and prevent erosion and sedimentation;
- monitoring construction activities to identify sources of erosion and to audit implementation of BMPs;
- conducting soil chemical tests to identify soil nutrient and macronutrient needs or toxicity problems prior to respread of soils and in areas of poor revegetation;
- tailings and waste rock would be sampled for constraints to revegetation including texture, coarse fragment content, and pH; and
- inspecting all seeded and planted areas annually during the active growing season to identify poor plant growth or damage and implementing remedial actions.

After final reclamation, revegetated areas would be protected for 2 years where necessary from vehicle and livestock use. Control of wildlife damage would be attempted. A noxious weed control plan would be developed in accordance with the Sanders County Weed District and, where applicable, with

Forest Service guidelines. No postoperational treatments (except nitrogen fertilizer, if appropriate) would be implemented other than normal forest practices.

Water Resources Monitoring Plan*. Sterling would submit a comprehensive long-term surface and ground water quality monitoring program (see Appendix K). Data collected from the monitoring program would be reviewed to evaluate the extent and magnitude of potential impacts during the proposed project's construction, operation, and postoperational periods. In conjunction with this plan, a Monitoring Alert Levels and Corrective Action Plan would be developed to ensure early detection of potential environmental degradation. The plan would identify alert levels, which when exceeded, would trigger a contingency or corrective action to be implemented.

Monitoring of Rock Creek, the Clark Fork River, and ground water in the vicinity of the mine and the paste facility would resume during evaluation adit construction to expand the monitoring baseline. Additional sites in the East Fork of Rock Creek, Copper Gulch, and the East Fork of Bull River may be required. Sterling would also conduct an additional springs and seeps survey above and below the ore body. Sterling would verify all water rights down gradient of the mine and resample all domestic wells and springs associated with those rights.

Long-term postoperational surface water monitoring of streams and springs would continue until the Agencies determined that water quality met state standards. Sampling stations would be located primarily on the main stem and east and west forks of Rock Creek, Miller Gulch, and the Clark Fork River.

Long-term postoperational ground water monitoring would focus on tailings storage facility seepage and ground water quality inside and outside the permitted mixing zone. Monitoring wells associated with the proposed seepage interception system would provide data to evaluate the system's effectiveness. Additional monitoring and interception wells may be added if monitoring showed degradation outside the approved mixing zone. Adit and mine discharge and seepage through the waste rock dump and mill pad also would be monitored.

Additional ground water quality sampling would be conducted at specified monitoring wells prior to construction of the proposed tailings facility to document water quality conditions in the tailings facility footprint downgradient of the decommissioned Noxon sanitary landfill. Samples would be analyzed for physical parameters, nutrients, common ions, metals, volatile organic compounds and semi-volatile organic compounds. If the results of sampling indicate the landfill is a potential source area for contamination, appropriate steps would be taken to mitigate the potential for additional problems in the future. Mitigative measures could include, but not be limited to, covering the landfill area with an impermeable synthetic material to reduce commingling of tailings leachate with landfilled materials.

Monitoring of lake levels, water balance, ground water exchange, and hydrostatic pressure in underground piezometers would continue at Cliff and Copper lakes and Moran Basin. If increased seepage was noticed in the mine workings, mining in the affected section would be halted and the problem investigated. The lakes would be visited and continuous lake level data would be retrieved and analyzed. Lake level fluctuations larger than predicted from baseline studies would be investigated using more intensive water balance methods (MT DEQ 2001). During this period, additional grouting would be required. Upon further data analysis, more measures could be required to lower the seepage rate. A plan to mitigate impacts to wetlands potentially affected by draining of these lakes would be developed as part of Sterling’s wetlands mitigation plan.

Assuming adit portals could not or would not be permanently sealed, postoperational adit flow would be discharged to the Clark Fork River via the water treatment system until it met water quality standards without treatment. Monitoring would be continued according to MPDES requirements. Sterling would investigate and fund alternative measures to ensure adit plug stability and postoperational adit water quality.

Influent and Effluent Monitoring*. The influent to the water treatment systems would be monitored for nitrogen and other parameters identified in the proposed draft MPDES permit in Appendix D and the monitoring plan attached in Appendix K. Characterizing the influent is critical for maintaining a consistent effluent. The influent would be monitored continuously so that system adjustments could be made whenever required.

Monitoring the effluent frequently is also critical in determining whether the treatment systems are operating properly and allowing adjustments to be made to the system to maintain a quality discharge. Effluent measurements would be made more frequently than required in the draft MPDES permit; the revised draft permit would require weekly or monthly monitoring depending on the parameter. Nitrates would be measured continuously with an on-line analyzer. These water quality results would be verified through weekly or monthly samples, depending on the parameter, and would be analyzed by a certified lab for permit compliance purposes.

Monitoring of Biological Oxygen Demand (BOD)*. Methanol would be added to the ABCs in an amount sufficient to sustain biological activity, but in small enough amounts to avoid excess BOD in the effluent. Excess BOD, similar to excess nitrogen, could cause unwanted aquatic growth. BOD in the effluent would be measured on at least a weekly basis.

Plant Species of Special Concern Mitigation and Monitoring Plans*. Mitigation and monitoring would apply to all lands within the permit boundary for threatened and endangered plants but only to Forest Service lands within the permit boundary for sensitive plants. Additional on-site verification studies would be performed during development of final facility designs to precisely locate any additional KNF sensitive plant populations as well as populations of MNHP plant species of special concern for avoidance. Sterling would be required to conduct or fund a conservation assessment if wavy moonwort or other sensitive species were located during final site surveys and preparation could not be avoided. Whenever the KNF sensitive species list is updated, Sterling would be required to revisit the various surveys conducted within the project area to determine whether or not those species as well as any new MNHP plant species of special concern had been identified and to determine whether or not suitable habitat for any of those species was located within the project area and sites scheduled for disturbance but not yet disturbed. If species were found or if suitable habitat exists, Sterling would need to conduct additional surveys to either relocate the populations previously identified in the surveys or determine whether or not the new species were to be found within the project area and if they would be disturbed. These reports would be submitted to the agencies along with plans, if necessary, for changes to the operating permit needed to avoid disturbance of these species. If avoidance could not be achieved, then a conservation assessment might be required by the Forest Service.

Springs and Seep Vegetation Monitoring Plan*. The proposed mining activity is a disturbance activity that may or may not alter the water table and therefore the habitat surrounding a spring or seep. The question of whether or not plant species will be affected by a change in water level and consequent spring or seep habitat as influenced by the Rock Creek mining activity is best answered by relating plant species with water abundance and quality for monitoring and evaluation. The following monitoring plan would be established to evaluate potential impacts to the plant community encompassing the springs and seeps that are in the project area.

- Initiate a survey to identify, document, monitor and evaluate wetland plant communities in non-surface disturbance areas (i.e., high/mid elevation springs and seeps) prior to the construction of the development adits. These wetland plant communities should be identified and monitored for their persistence in relation to ground water diversions associated with mining activities. Surveyed areas, should incorporate the identification of facultative and obligate wetland plants and associated hydrophilic sensitive, threatened and endangered plant species. This information would be related to and coincide with the water quality quantity sampling of springs as discussed in the Water Quality Monitoring Plan, Chapter 4 and Appendix K.
- A professional botanist/plant ecologist would design survey methodology and protocols.
- Initial surveys should be semi-permanent and contain site photo points and GPS site locations.
- Initial surveys should contain basic site descriptors, hydrophilic plant species (facultative and/or obligate) and their relative frequency.
- One or two indicator hydrophilic plants (obligate) and their relative frequency should be chosen from the initial survey information - trigger plants.
- A botanist/plant ecologist would gauge observable increases should use trigger plants and associated rapid observational percentage/frequency information or decreases in obligate plant species.
- Trigger plants will serve as a basic "trigger" to begin additional monitoring in a particular site. Other water quantity and quality information will be used to facilitate or strengthen monitoring decisions.
- If a change in flow or water quality is noted outside the baseline data for an individual site or set of sites, then a re-evaluation of those potentially affected plant communities would be conducted and documented for comparison against initial survey information. If water quality or flow remain within baseline parameters, then on a five year cycle a survey in areas of current development would be conducted and compared to the initial survey.
- If, as a result of the proposed action, trigger plant percentages are declining to a level where population numbers may affect reproduction of the species for that site, then the agencies may require additional monitoring effort for the following year. Dependent on a combination of biological variables and/or the severity of plant indicator decline, the agencies can insist on a more in-depth monitoring effort. If a "trigger" plant declines two years in a row, then additional monitoring may be required for the following year.

Wildlife Mitigation and Monitoring Plans*. Sterling's fish and wildlife mitigation plan under Alternative II was formulated to minimize and/or mitigate the effects of the mine operation. Mitigation measures proposed and carried forward into the agency alternatives include the following:

- conspicuously posting all applicable state and federal hunting, fishing, trapping and recreation regulations. Meeting with appropriate regulatory agencies to discuss regulations to be posted, locations of signs, and any special regulations pertinent to adjacent lands;
- developing and enforcing wildlife policy to prohibit carrying of firearms in Sterling vehicles, hunting within Sterling property by employees and the public, unauthorized

off-road vehicle use in the project area, and to discourage wildlife harassment and littering;
- minimizing vehicular disturbance by dust suppression, paving, speed limit enforcement, and encouragement of carpooling;
- cooperating with appropriate agencies regarding trespass, game violations, or other wildlife problems; and
- maintaining access to public lands adjoining the project area.

Sterling's fish and wildlife mitigation plan would be modified to incorporate the following measures to monitor and mitigate impacts on wildlife (a separate plan is described below for aquatics and fisheries mitigations and monitoring requirements) under all agency alternatives:

- monitoring or funding USFS monitoring of closed roads and trails (such as Government Mountain and Orr Creek roads) to determine if inappropriate use was occurring;
- creating bat habitat in the evaluation adit and/or the air-intake ventilation adit, if determined to be appropriate by the Agencies; and
- using selection criteria for the air-intake ventilation adit site in the CMW that would help minimize impacts to mountain goat habitat.

Additional mitigation measures were added under Alternative V to prevent or minimize disturbance to harlequin ducks during breeding season. These include:

- limiting operating seasons during construction,[19]
- busing of mine employees,
- relocating the evaluation adit support facility to lower elevation,
- eventually closing and reclaiming FDR No. 150B,
- screening of disturbance zones, prohibiting camping on Sterling lands,
- monitoring water quality and developing a hazardous material spill plan relative to harlequin ducks; and
- designing FDR No. 150 to minimize stopping adjacent to the creek while being consistent with appropriate safety standards,

The agencies would continue working with MDFWP to try to institute a delay of fishing season opening date on Rock Creek to reduce the numbers of people potentially in or near the creek during critical harlequin duck seasons. Additional harlequin duck mitigations are planned and identified in the Wildlife Mitigation Plan pending agency and Sterling negotiations.

Mitigations to prevent road impacts to fisher include wildlife crossing structures along FDR No. 150. Lighting mitigations would be incorporated at the mill site to avoid attraction of and mortality to night migrating songbirds.

Mitigation for several species would be accomplished concurrently with grizzly bear mitigation. These would include road closures for wolverine, and securing of private land habitat for fisher and lynx.

---

[20] Specific construction activities restricted by the limited operating season conditions during construction phase include hauling of waste rock from the adits to paste facility, bridge construction or reconstruction, road construction or reconstruction and within the areas where disturbance would be a factor, construction of the water pipeline across the lower portion of Rock Creek, construction of paste pipelines across Rock Creek, and construction of the utility corridor at locations where disturbance would be a factor.

Although the securing of private land would not create any additional habitat other than road closures to increase habitat effectiveness, this mitigation would secure the sites from almost inevitable habitat alteration as a result of regional increases in human development unrelated to the project. Removal of carcasses killed by vehicles from roadsides would reduce mortality risk to carrion eaters other than grizzly bears.

Other mitigations would include funding for MDFWP law enforcement personnel to protect mountain goats and other wildlife species, and development and implementation of information and education programs for the public about wildlife species. This mitigation would be accomplished with the positions required under the Threatened and Endangered Species Mitigation Plan.

A wildlife monitoring plan found in Appendix K would be finalized to:

- coordinate with other programs to monitor impacts to neotropical migrant birds;
- assess mountain goat population trends, habitat use, and responses to mine-related impacts in cooperation with MDFWP;
- gain an increased understanding of wolverine and mountain goat population trends as a result of mine-related effects and other regional effects and to help ensure prompt detection of declining population trends, should they occur. Current monitoring levels would not enable wildlife biologists to detect trends in a timely fashion; and
- assess other sensitive species for population trends, habitat use, and responses to mine-related impacts in cooperation with KNF.

Threatened and Endangered Species Monitoring and Mitigation Plans*. The monitoring and mitigation plans for threatened and endangered species under Alternative V were developed from a number of sources. The plans began with what was submitted in Sterling's permit application and were expanded with plans in the draft and final BAs. During the formal consultation with the USFWS additional items were added to these plans to address requirements in the Biological Opinion (BO) on grizzly bears (see Appendix E).

A mitigation plan was developed by Sterling to mitigate effects on threatened and endangered terrestrial species. (Bull trout would be covered by mitigations in the Aquatics and Fisheries Monitoring and Mitigation Plans.) In addition to the measures suggested above for wildlife, Sterling would:

- construct Power lines following criteria outlined by Olendorf, Miller, and Lehman (1981) to reduce potential for electrocution of bald eagles; and

- develop and implement a grizzly bear management program in conjunction with appropriate state and federal agencies.

In addition to what was proposed by Sterling, the following items would be required to reduce or eliminate consequences to species federally listed as threatened or endangered. The detailed mitigation plan to be implemented by Sterling and appropriate state and federal agencies is in the Biological Assessment in Appendix B of the final EIS. The final Threatened and Endangered Species Mitigation Plan must be approved by the KNF and the USFWS prior to construction of the evaluation adit and several components of the plan would be implemented prior to or during evaluation adit construction. The items listed below incorporate the requirements of the Reasonable and Prudent Alternative, Reasonable and Prudent Measures, and the Terms and Conditions in the USFWS Biological Opinion

(BO) on grizzly bears. These are also listed in the revised mitigation plan attached to the BA in Appendix B.

To reduce mortality risk to threatened and endangered species Sterling would:

- develop a transportation plan to minimize mine-related vehicular traffic traveling between Montana Highway 200 and the mill site, and minimize parking availability at the mill site; this would be accomplished primarily by busing employees from the support facilities site or water treatment site to the evaluation adit or mill site respectively;
- not use salt when sanding during winter plowing operations to reduce big game mortality that could draw bald eagles, wolves, and grizzly (in spring) to the road corridor and increase mortality;
- remove road-killed animals daily from road rights-of-way within the permit area and along roadways used for access or hauling ore. Road kills would be moved at least 50 feet beyond the right-of-way clearing and further, if necessary, to be out of sight from the road;
- construct power lines following criteria outlined by Olendorff, Miller and Lehman (1981) to reduce potential for electrocution of bald eagles;
- work with other mines operating in the area (e.g., Noranda) to fund a local MDFWP law enforcement position for the life of the mine[10] and a MDFWP public information and education officer to aid in grizzly bear conservation.[20] The position would be funded for 3 years and then evaluated for need to continue or modify to better benefit grizzlies. This position must be in place prior to evaluation adit construction;
- bear-proof all project-related containers holding attractants and remove garbage in a timely manner;
- not use clover in the seed mix used on any disturbed areas during mine operation;
- prohibit employees from carrying firearms within the permit area, except for security personnel.
- prohibit employees from feeding wildlife, especially bears and require all mine employees to attend regular training related to living and working in grizzly bear habitat; and
- fund items necessary for implementation of a KNF food storage order in Bear Management Units 4, 5 and 6, as required by the USFWS in the BO including bear-proof garbage cans for campgrounds and possibly bear-resistant food storage/camping equipment that can be rented from the KNF to backpackers in the lower Cabinet Mountains.
- require employees to attend initial training on living in bear country and annual refresher training.

To maintain habitat effectiveness for threatened and endangered species, Sterling would:

- secure or protect (through conservation easement or acquisition) replacement habitat to compensate for acres lost by physical alterations or acres with reduced habitat availability due to disturbance; 2,450 replacement acres would be required of which 100

[21] This would be the same position as required in the RODs for the Montanore Project for threatened and endangered species mitigation, not an additional one.

acres must be located in the north-south corridor to mitigate for habitat constriction. Out of that 100 acres, 53 acres would have to be acquired prior to evaluation adit construction, the rest would be acquired as outlined in the biological assessment and the biological opinion--all acquisitions must be approved by the KNF and the USFWS; and

- fund grizzly bear habitat enhancement activity on 484 acres that include but are not limited to prescribed fire, road closures, and road obliteration;

To reduce mortality risk, maintain habitat effectiveness, reduce incidental take and avoid jeopardy for threatened and endangered species, Sterling would:

- work with private and corporate landowners within and adjacent to the Rock Creek drainage to close their roads to benefit grizzly bears;
- fund 5.22 miles of road closure by the KNF on NFS lands as well as possible closure of other roads and trails associated with the 2,450 acres of lands acquired to maintain habitat effectiveness as described above;
- fund KNF monitoring of recreational use on the Rock Lake and St. Paul Lake trails to help control use levels. A recreational use management plan would be developed to control usage, and would be implemented when high use occurred during one bear season.
- implement a food storage order for Bear Management Units 4, 5, and 6 prior to allowing Sterling to start the evaluation adit.

To reduce mortality risk and maintain habitat effectiveness for threatened and endangered species, KNF would close a total of 5.22 miles: 1.61 miles of FDR No. 2285 (Orr Creek Road), 0.51 miles of FDR No. 2741A, 0.18 miles of FDR No. 2741x, and 2.9 miles of FDR No. 150 (Government Mountain Road). Chicago Peak Road (FDR No. 2741) would remain open. These road closures would need to be completed prior to mine construction and development. KNF and the USFWS would evaluate the potential of and need for additional road and trail closures associated with the 2,450 acres of lands acquired by Sterling to maintain habitat effectiveness as those lands were acquired. KNF would also monitor recreational use on the Rock Lake and St. Paul Lake trails to assure use levels do not exceed the “high use” designation.

To address habitat constriction, secure or protect from development and use 100 acres of replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identified under mitigation item B-1 (see revised Threatened and Endangered mitigation plan in Appendix B).

Sterling would be required to finalize a monitoring plan to ascertain the effectiveness of the various mitigations on grizzly bears and their habitat. Sterling would:

- monitor or fund the cost of monitoring the effectiveness of road closures and the recreation use management plan for trails described above and included in the Wildlife Monitoring Plan;
- fund the cost of radio telemetry monitoring of grizzly bears in the lower Cabinet Mountains by the USFWS;
- monitor number of road kills on project-related roads and any use of those kills by grizzly bears; and

- monitor and report within 24 hours all grizzly bear, bald eagle, lynx, and wolf mortalities within the permit area.

Sterling would establish a trust fund and/or post a bond, prior to initiating any activities, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond would be commensurate with projected work and associated mitigation items. See the revised mitigation plan in the terrestrial species BA in Appendix B for more detail.

As soon as DEQ permits and KNF approvals are obtained, if the agencies decide to approve the proposed action, Sterling would need to enter into a Memorandum of Understanding/Agreement with the USFWS, the USFS, MDFWP, and other applicable agencies to specify when all components of this plan will be finalized and implemented as required by the Reasonable and Prudent Alternative and the Reasonable and Prudent Measures in the BO for grizzly bears. The MOU would establish roles and responsibilities of all participants and outline their commitments. The MOU would also set timelines for development of access management plans, describe the process for approving mitigation land, specify the wording for conservation easements, provide the framework for any proposed land exchanges related to mitigation acres, and outline job descriptions and work tasks for the two MDFWP positions.

Aquatics and Fisheries Monitoring and Mitigation Plans*. These plans, prepared and implemented in cooperation with MFWP, USFWS, and the Agencies, would remain essentially the same as described for Alternatives III and IV except that sediment reduction would be based on reducing tons of sediment per year rather than on an acreage basis and several additional items have been added to comply with the Reasonable and Prudent Measures and Terms and Conditions of the USFWS BO for bull trout (See Appendix E).

A more detailed mitigation plan would be required to address remaining populations of threatened and sensitive aquatic species. Under the Reasonable and Prudent Measures and Terms and Conditions sections of the BO for bull trout, Sterling would be required to conduct a watershed assessment to: (1) better define bull trout populations (distribution, densities, age class structures, growth rates, fecundity, and status of resident and migratory populations), and (2) better define habitat conditions (spawning, rearing and overwintering conditions, including temperature monitoring).

Under the terms and conditions of the BO for bull trout, Sterling would also be required to implement a stream habitat enhancement program to improve the ability of bull trout to move throughout the year in Rock Creek and increase habitat availability and diversity for migratory and resident bull trout populations. Whenever possible these mitigations should be coordinated with work being done by Avista or the local watershed council to avoid duplication of efforts.

A sediment source reduction plan would be required to reduce sediment in spawning gravels. Sediment source reduction activities would be completed prior to the mine construction period and maintained throughout the life of the mine. The sediment source reduction plan would need to incorporate the BMPs described under Erosion and Sediment Control above. The plan would also include measures to improve in-stream sediment transport such that streambed scouring and sediment storage would be enhanced. This strategy will also result in the development of pools and stable riffles; therefore increasing habitats for fish and macroinvertebrates as required under the habitat enhancement plan described above. Sterling would be responsible for:

- identifying sediment sources within the Rock Creek watershed such as culverts, road impacts, bridges, past bank stabilization efforts, and utility right-of-way impacts (one specific site, an eroding cutbank where Engle Creek joins Rock Creek should be included for mitigation) focusing initially on NFS lands, lands within the drainage acquired to mitigate impacts to grizzly bears, and then other privately owned lands;
- developing a plan to reduce 400 tons of sediment per year within and outside of the permit area in the Rock Creek drainage, upstream of spawning areas, and during or prior to mine construction. A sediment monitoring program would be implemented throughout the life of the mine to ensure the sediment reduction mitigations were effective and to determine the actual effect of the project and mitigation activities on sediment levels in the drainage;
- leaving an unaltered vegetation zone between Rock Creek and the road and utility corridors, where possible during new construction, to protect bull and westslope cutthroat trout habitat;
- installing sediment catchment basins in road ditches in areas where fine sediments could be transported to streams from application of sand during winter; and
- working with the KNF to complete a road systems analysis to define existing and future road uses and closures.

Mitigation would include funding for personnel (the law enforcement personnel mentioned under the Wildlife Mitigation Plan and the Threatened and Endangered Species Mitigation Plan above) to protect bull and westslope cutthroat trout through enforcing the law and informing and educating the public. Angling pressure in Rock Creek and it tributaries would likely increase due to improved access and increased use. Bull trout harvest is not allowed, but the fish is often misidentified by the public. Westslope cutthroat trout are highly susceptible to angling, therefore, harvest rate information and protection are needed.

The BO for bull trout also includes two new reasonable and prudent measures to be implemented prior to mine construction. The first would require Sterling to submit an evaluation of operational options of the proposed diffuser at the proposed location and alternate sites below the Noxon dam. The second would require Sterling to submit a risk assessment of potential accidents related to haul routes for mine-related risks to bull trout and make recommendations for additional measures to minimize the risk.

The KNF worked with the USFWS and evaluated various diffuser options available (USFS 2001a). Moving the diffuser upstream either just below the Noxon Dam or within the reservoir would not address the issue of concern by the USFWS about potential impacts to migratory or resident bull trout using the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream. The agencies instead considered operational constraints. Sterling would be required to discharge water from the southernmost ports initially and gradually add ports to the north as the volume of water increased. Sterling would work with FWP and USFWS to study how bull trout migrated past the diffuser to determine if changes would be necessary in the MPDES permit to modify the number and location of diffuser ports and possibly the size and shape of the mixing zone. Changes to the MPDES permit could be requested at any time or during DEQ's 5-year review cycle.

KNF and USFWS also conducted a road risk assessment for the second item (USFS 2001b). It was determined that the two bridges and one culvert identified during the risk assessment incorporate concrete or earthen barriers on both sides of the crossings to prevent either a vehicle or its contents from entering the stream if an accident occurred. Secondly, the final design incorporate BMPs to minimize the risk of failures and associated impacts to bull trout.

A conceptual monitoring plan is found in Appendix K. Sterling would be required to monitor impacts to benthic macroinvertebrates, fish populations, and periphyton. Metals accumulations in fish tissues and sediments, and increases in sediment loads would also be monitored. Additional monitoring sites would be required. Monitoring of sediment sources during construction would be conducted under the Reclamation Monitoring Plan found in Appendix K.

To ensure that withdrawal of ground water does not reduce the quantity of surface water, springs would be periodically monitored as specified in the Water Resource Monitoring Plan in Appendix K. For similar reasons, the flow of Rock Creek at its mouth would be routinely monitored as required by the MPDES permit and the Water Resources Monitoring Plan and described in Appendices D and K respectively. Additional ground water monitoring may be necessary to comply with the terms and conditions for implementing the Reasonable and Prudent Measures in the bull trout Biological Opinion and would be incorporated into the appropriate monitoring plans as needed. Additional monitoring at the mouth of Rock Creek would be done for fish, as described in Appendix K.

Cultural Resource Monitoring Plan. Monitoring is recommended during any land disturbing activity (state, federal, and private) that has potential to adversely impact any unidentified sites for Alternatives II through V. The areas to be monitored are identified and discussed in Appendix K. Monitoring must be completed by a qualified archaeologist who meets the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716). All four tribes would be afforded an opportunity to monitor the activity. Should a site be discovered during project implementation, activity should stop until the site is formally recorded and evaluated for eligibility to the National Register of Historic Places. Evaluation should consider traditional tribal history. Should a site be determined to be eligible (in consultation with Tribes and formal review of the Montana State Historic Preservation Office-MTSHPO), consideration of effects of continuing with the project activities should be characterized (36 CFR 800.5). A determination of adverse effect should result in the design of mitigation measures. Mitigation measures will be described in a plan for site protection or data recovery. Mitigation plans require consultation with Tribes, and formal review by the MTSHPO and the Advisory Council on Historic Preservation, resulting in a Memorandum of Understanding.

Hard-Rock Mining Impact Plan. Because the demands for local government services created by the project would not coincide with the boundaries of the affected local government districts, and because the tax revenue from the project would be generated too late to allow local government entities to respond in a timely fashion to the increased demand for their services resulting from mine construction and startup, the Montana Hard-Rock Mining Impact Act requires preparation of a Hard-Rock Mining Impact Plan. The applicant completed this plan in coordination with Sanders County and other affected jurisdictions (ASARCO Incorporated 1997b) and the plan was approved by Sanders County on October 21, 1997. The plan provides a coordinated mechanism for allocating project tax revenues to local government jurisdictions that would experience increased capital and operating costs but not receive appropriate project tax revenues. It also calls for prepayment of selected local taxes where revenues would lag behind demands on local government services.

The impact plan forecasts project-induced increases in operating revenues, and net operating costs for 19 affected local government jurisdictions. Under the plan, an estimated total of $725,000 in tax pre-payments would be made during project construction and startup. These prepayments would be treated as credits against Sterling's future local tax liabilities. In addition, special grant payments (estimated $158,500) would be made to alleviate inequities in location and timing of local government receipts. The plan includes conditions that would trigger adjustments or amendments to the plan if impacts prove to be greater than expected.

Wetlands Mitigation Plan. The use of tailings paste landfill technology for tailings disposal eliminates the need for borrow materials outside of the paste facility site to construct starter dams although some rocky material would be required for constructing the toe buttresses. The primary mitigation site under Alternatives II through IV relied on the excavation of borrow material from Borrow Area 3 adjacent to Rock Creek near the tailings impoundment. The elimination of this 7.5 acre mitigation site has required a modification in the applicant's 404(b)(1) application to the Corps of Engineers (ASARCO Incorporated, 1997c). Pertinent details and aspects of the applicant's wetland mitigation plan for Alternative V is provided in Appendix L and the Agencies' revised 404(b)(1) preliminary showing is provided in Appendix F. The plan is summarized below. The primary functions and values of the created wetlands would be to reestablish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek and Miller Gulch, and attenuate peak flows.

The applicant has identified about 18.9 acres of higher terraces, benches, and abandoned channels that are typically above the water table and located along Miller Gulch, Rock Creek, and the Clark Fork River that would be suitable for the development of linear wetlands (see Figure 2-39). The Miller Gulch Tributary sites identified in Alternative II would still be used for wetland mitigation (see Figure 2-39). Optional mitigation sites in six areas have also been identified for use should the proposed sites prove unfeasible if the projected created wetlands fail to meet the proposed goals of any of the sites, or if the COE would require additional mitigation beyond a 1.5:1 replacement ratio. Plans for the optional sites have not been prepared but would involve similar designs to those described below but modified to best suit the characteristics of each site. The mitigation sites would be developed for wetland establishment by excavating the sites, topsoiling, and planting appropriate wetland vegetation species. Whenever possible, soils taken from impacted wetlands would be used. These sites would be constructed during evaluation adit and project construction to allow the maximum amount of time for stabilization and any required modifications to achieve success prior to mine closure and reclamation (see Table 2-18).

The Miller Gulch wetland mitigation sites would consist of a series of linear wetlands created along a side drainage to the South Fork of Miller Gulch. This side drainage currently does not contain wetlands but may be similar in size to other nearby drainages that do support wetlands. Establishment of wetland hydrology in the side drainage would rely on flow barriers designed to retain seasonal surface water runoff and thus increase the duration of saturation and inundation on low permeability, poorly-drained soils. These mitigation wetlands likely would be inundated to an average depth of 1 foot for 3 to 4 months during snowmelt runoff (March through May or June) and partially inundated or saturated through July and August.

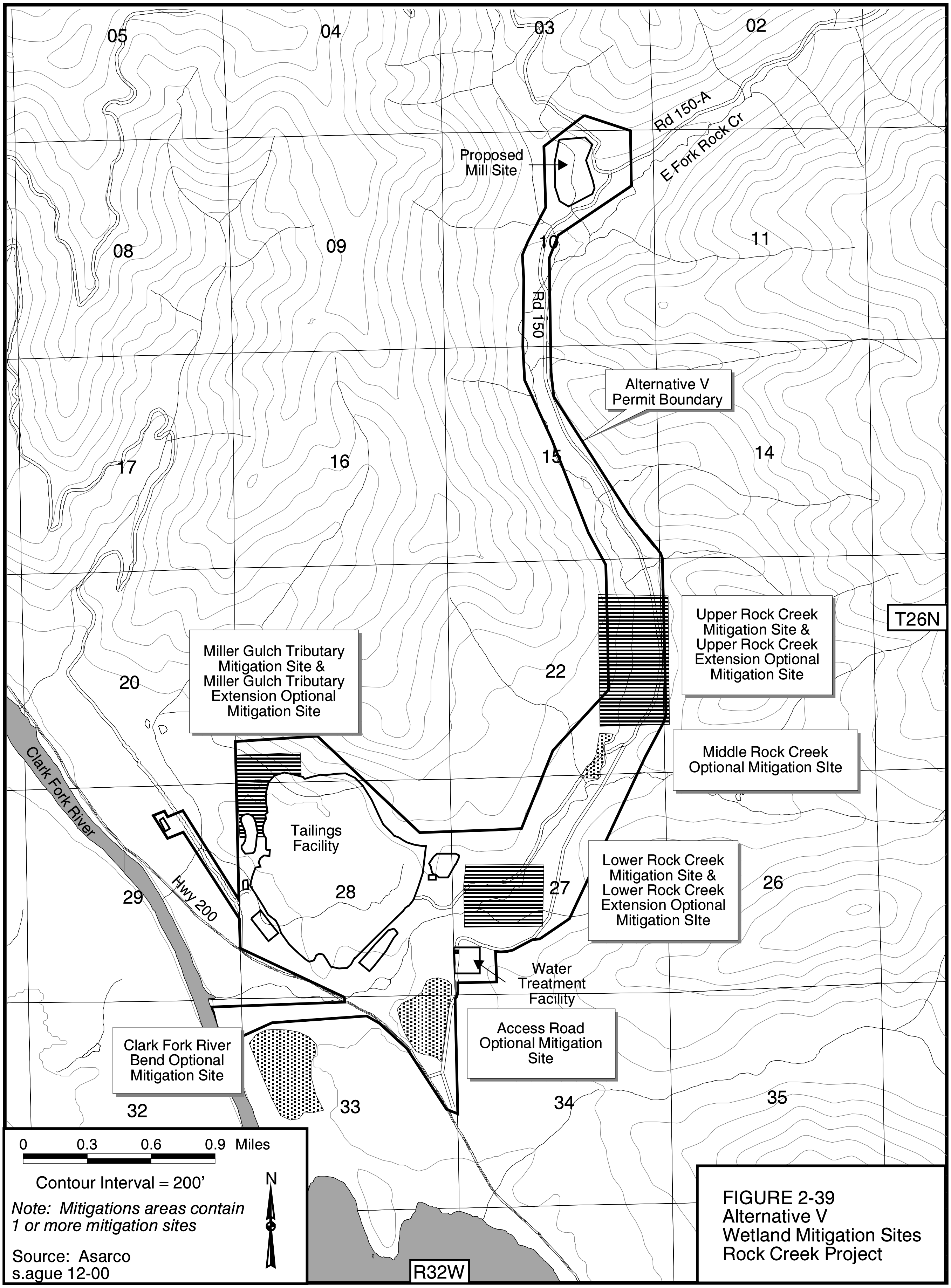


FIGURE 2-39
Alternative V
Wetland Mitigation Sites
Rock Creek Project

TABLE 2-18
Available Acreage and Schedule for Created Wetlands for Alternative V

Wetland Mitigation Sites	Created Acreage	Mitigation Site Construction[1]	Projected Resumption of Comparable Functions
Miller Gulch Tributary	1.2	Preproduction Year 3	Production Year 22[3]
Upper Rock Creek			
Stage 1[2]	1.1	Preproduction Year 1	Preproduction Year 4
Stage 2	3.3	Preproduction Year 3	Production Year 1
Lower Rock Creek	1.4	Preproduction Year 5	Production Year 3
Six Optional Wetland Mitigation Sites			
Upper Rock Creek Extension	1.60	Preproduction Year 3	Production Year 1
Miller Gulch Tributary Extension	1.00	Preproduction Year 5	Production Year 3
Lower Rock Creek Extension	0.30	Preproduction Year 5	Production Year 3
Access Road	3.0+	Preproduction Year 1	Production Year 4
Middle Rock Creek	1.00	Preproduction Year 3	Production Year 1
Clark Fork River Bench	5.0+	Preproduction Year 3	Production Year 1
TOTAL WETLAND CREATION	**18.9**		

Notes:
1 Schedule based on 5 years preproduction activity, 25-30 years production, and 5 years post-production closure and reclamation.
2 Upper Rock Creek Stage 1 will involve 1.1 acres of mitigation. Stage 2 will include the remaining 3.3 acres and will address any changes necessary based on results of Stage 1 mitigation.
3 This mitigation site is proposed as a forested wetland and 25 years are projected to allow trees to develop to provide comparable functions as disturbed forested wetlands.

Small retention dikes would be constructed at approximately 200-foot intervals along the full length of the side drainage of Miller Gulch. The dikes would be 30 to 50 feet long and a maximum of 5 feet high. Each dike would contain a rock-lined spillway. If the saturated hydraulic conductivity of the soil and substrate was greater than 2.8 x 10^{-4} ft/day, a clay sealant or PVC liner would be used. Hydric soils from the impacted wetland areas of Miller Gulch would be salvaged and directly respread on the mitigation sites to provide increased organic matter and a plant materials source. The sites would be broadcast seeded with a forested wetland mixture and trees and shrubs planted. Straw mulch would be applied. The primary wetland functions of the proposed Miller Gulch created wetlands would be to reduce sediment transport, increase aquatic and terrestrial habitat diversity and abundance, and attenuate peak flows.

The upper Rock Creek wetland mitigation site is located on the east side of Rock Creek near mile post 3, north of the confluence of Rock Creek with Engle Creek. The wetlands would be constructed in the streamside terrace with the wetland hydrology provided by ground water. The upper and lower Rock Creek wetland sites were investigated in November 1996 (ASARCO Incorporated 1997c) and ground water was encountered at about 8 feet below ground surface. Trees and shrubs would be removed from the site and topsoil stockpiled in non-wetland areas adjacent to the site. Linear channels would be excavated down to ground water depths, estimated at 6 to 8 feet below the surface. The width of the bottom of the linear channels would vary from 10 to 25 feet. Benches, 6 to 12 inches tall, would be constructed on one or both sides of the bottom to create zones with variable periods of saturation or inundation. Side slopes would vary reflecting excavation depth and adjacent natural topography. In general, one side of the excavation would be relatively steep (40 to 50 percent) with the opposite side constructed at a gentle to moderate slope (10 to 40 percent).

The lower Rock Creek site is located on a gently sloping toe-slope and bench primarily between FDR No. 150 and Rock Creek just opposite the road leading to the paste plant and northwest from the water treatment plant. A small segment would be located west of the road. The site includes a portion of the area designated as Borrow Area 3. Alternative V does not incorporate the use of borrow from this site at the tailings disposal site; however, if the final tailings paste disposal design changes that requirement, the wetland mitigation design would be modified to account for any topographic changes. After tree and shrub removal and soil salvage and storage had taken place, linear channels would be excavated to a depth of 2 to 3 feet with variable widths between 10 and 25 feet. Side slopes would vary between 50 and 20 percent. Small depressions would be constructed along the longitudinal profile of each channel to increase water retention. If necessary, small flow barriers (detention dikes) similar to those proposed for the Miller Gulch tributary mitigation site would be constructed across the channel to create additional diversity in wetland hydrology by creating longer periods of inundation or saturation upstream of the dike. If scouring occurred at the outlet of the channels, rock energy dissipaters would be constructed.

The Rock Creek mitigation sites would be topsoiled with 12 to 13 inches of salvaged soil. The sites would be revegetated with a herbaceous revegetation mix. Channel side slopes and any berms created with excavated materials would be seeded with the project's standard upland herbaceous mix. Since the narrow configuration of the mitigation sites would preclude effective drill seeding, the sites would be broadcast seeded. The sites would then be mulched with noxious weed-free straw (2,000 pounds/acre) or cellulose fiber hydromulch (1,500 pounds/acre).

Provisions would be included in the plan, as required by COE as part of the 404 permit, to develop a contingency plan to mitigate impacts to wetlands in the wilderness, should mining result in loss of water to or from Cliff and Copper lakes and Moran Basin. An aquatic life mitigation plan would be prepared in conjunction with the wetlands mitigation plan for wilderness lakes.

A monitoring plan using standardized wetland assessment techniques for determining wetland functions and values would be required by the COE to monitor impacts to wetlands and non-wetland waters of the U.S. during mining and to evaluate the success of re-establishing the functions and values at the wetland mitigation sites. This plan is described in Appendix L.

PART III: ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER STUDY

A number of alternatives suggested during scoping have been determined by the Agencies to be infeasible or otherwise unreasonable. The alternatives discussed in this section were evaluated and have been dismissed from further consideration. The reasons for dismissal are described in the following sections. Agency evaluations used the Kootenai National Forest Plan (U.S. Forest Service KNF 1987), the MAC Report (U.S. Forest Service KNF 1986), and analyses conducted by the applicant as part of the project planning process.

Dismissed alternatives fall under the twelve topics listed below.

- other recoverable ore bodies;
- mill and mine portal siting alternatives;
- tailings impoundment siting and construction methods alternatives;
- tailings paste deposition siting alternatives;
- McKay Creek impoundment alternative;
- McKay Creek water retention dam;
- other tailings disposal and transport methods, including backfilling;
- lined tailings disposal facility;
- rail siding (loadout) alternatives;
- combined operations (Rock Creek and Montanore);
- alternate water treatment methods; and
- socioeconomic alternatives.

Other Recoverable Deposits

The applicant has made an extensive evaluation of the surrounding area. In 1993, ASARCO relinquished all of its rights and interests in two other deposits because no economic concentrations of copper and silver were found. Currently, Sterling's mining claim holdings in the western Montana copper-sulfide belt are solely related to the Troy Mine and the Rock Creek Project. Economically recoverable copper and silver deposits are rare and difficult to find. Even if Sterling does hold other recoverable copper and silver mining claims or could purchase others elsewhere, any other recoverable claims are not considered reasonable alternatives because the applicant has asked for a response to a specific ore body. The location of this specific ore deposit necessarily controls the location of the mine.

Mill and Mine Portal Siting Alternatives

Initial investigations concerning mill and mine portal site alternatives were conducted by the Forest Service and published in the 1986 MAC Report. The MAC Report recommended that the EIS evaluate in detail three mine portal and two mill site alternatives in combinations of sitings. These sites are identified as sites I, J, and K (see Figure 2-1). Site I is Sterling's proposed mill site, Site J is on the ridge above the confluence of east and west forks of Rock Creek, and Site K is the confluence mill site.

Site I was used for the mill in Alternatives II and III. Mill and portal site K was used in Alternative IV. According to Sterling's baseline geology report, Site I was not a feasible portal location because the bedrock there was not suitable.

The two remaining siting alternatives recommended separating the mine portal locations from the mill site. The mill was located at Site K for both alternatives and was connected to a mine portal at either Site I or J by an ore conveyor and access road. Site I was not suitable for a mine portal as described above. Site J was considered, but was dismissed from further study because it was more visible from the wilderness and FDR No. 150 than Alternatives III and IV and offered no distinct resource-related advantage over a mine portal at Site K.

The MAC Report also considered other mine portal and mill site alternatives but did not recommend them for further study. These include sites in the East Fork of Rock Creek and the Bull River drainage. The East Fork Rock Creek sites did not offer any advantages over other alternatives included in the EIS. The Bull River sites were not considered in detail because of distance from portal locations, grizzly bear habitat, and the relatively pristine nature of the potentially affected drainage.

Tailings Impoundment Siting and Construction Method Alternatives

Several tailings impoundment studies have been conducted for this general area. Sterling conducted an impoundment site evaluation in 1984 prior to selecting the proposed site. The MAC Report also identified and evaluated a total of 21 potential tailings impoundment sites. U.S. Borax, and later Noranda, conducted impoundment studies in this area associated with Noranda's Montanore Project. The ID team examined these reports during preparation of this final EIS. These analyses further evaluated alternative impoundment sites, impoundment construction methods, and tailings disposal methods. Results of these analyses are summarized below. (Refer to the analysis in Appendix G for a more detailed discussion.)

Construction Methods

Typically, there are two general types of retention dams used to contain mill tailings: (1) an earthen embankment constructed entirely with material other than tailings, and (2) an embankment consisting of some mixture of tailings and other earthen materials. The first general type of retention embankment is essentially similar to the type of dam used to impound a water reservoir and typically is used when the tailings require complete hydraulic isolation from the surrounding environment and/or the total amount of tailings is rather small. This kind of embankment is constructed prior to deposition of tailings and is built entirely with nontailings material. This type of impoundment construction was dismissed from further consideration because a large quantity of borrow material would be needed. Excavation of the borrow sites would result in several hundred acres of additional surface disturbance. The borrow would be expensive to excavate, transport, and place on the embankment.

The second general type of tailings retention embankment is constructed using the sand fraction of the tailings as a portion of the embankment construction material. The general construction sequence for this kind of tailings impoundment involves the construction of starter dams with nontailings material, much like the water reservoir dam discussed above. However, unlike a water reservoir dam, starter dams serve only to provide the beginning of the tailings embankment structure and are typically much smaller in both height and lateral extent than the final tailings impoundment.

This type of tailings retention structure is sequentially raised with stages of embankment construction rather than completely constructed prior to tailings deposition. Therefore, it is referred to as a staged embankment. Staged embankments are described by the direction the crest the embankment moves during construction; upstream, downstream, and centerline (see Figure 2-3). Additional detail on impoundment construction may be found in Appendix G.

The Agencies did not dismiss any staged embankment construction method. The type of impoundment construction did, however, play a role in the dismissal of impoundment sites as described in the next section.

Alternative Impoundment Sites

The MAC Report (U.S. Forest Service KNF 1986) identified four potential tailings disposal sites for a mine/mill complex located in the Rock Creek drainage. Further discussion of these four sites is included in Appendix G and Thompson 1989. Of these four sites, three were carried forward for further evaluation, they are: Rock Creek (MAC Report Site 11A), Swamp Creek (MAC Report Site 21), and Noxon Bench (MAC Report Site 10). The fourth site was eliminated because it was not large enough to handle the volume of tailings projected to be generated from mining the Rock Creek ore deposit. During the EIS process, the Agencies added the McKay Creek site to the three identified in the MAC Report, resulting in a total of four sites that were further evaluated as potential tailings impoundment locations. Agency evaluations combined both siting options and construction alternatives as well as using two impoundment sites concurrently. Table 2-19 summarizes these evaluations.

Tailings/Paste Deposition Siting Alternatives

The Agencies reevaluated the four sites from the MAC Report and the McKay Creek site for suitability for tailings paste deposition. The change in the method of disposing tailings did not eliminate the primary reasons for dismissing the use of these sites for a tailings impoundment. Additional reasons relating to paste deposition technology provide more rationale for dismissal from further consideration. Table 2-20 summarizes these evaluations. Results of these analyses are summarized below. (Refer to the analysis in Appendix G for a detailed discussion for dismissing these sites for a tailings impoundment.)

McKay Creek Impoundment Alternative

The Agencies considered the McKay Creek site even though it did not meet previously mentioned selection criteria (see Issues and Development of Alternatives Process). This was because it seemed to be the most feasible impoundment siting that addressed the issues of tailings dam stability in terms of construction methods and retention of visual quality in the Clark Fork Valley near Noxon. As such, it was considered in substantially more detail than the other impoundment siting options dismissed in the previous section. Because this alternative did not have an engineered design and sufficient baseline data, the Agencies developed conceptual plans and assumptions about site conditions to guide their assessment of the environmental impacts (see Appendix M for more detail). A brief summary is included below.

Description

This alternative would have had similar components to Alternative IV except for the proposed tailings impoundment site. Powerlines, slurry and reclaim pipelines, and roads would have been longer than Alternative IV due to relocation of the impoundment (see Figure 2-40).

This conceptual alternative tailings impoundment site was located in the McKay Creek drainage, about 2 miles east of the mouth of Rock Creek. A dam using the downstream method of construction, approximately 1,500 feet wide and about 180 feet high, would have been placed across the mouth of the valley. The impoundment would have covered approximately 510 acres in the drainage and buried over 2 miles of McKay Creek. A major diversion of McKay Creek, 15,000 feet long and sized to channel the

TABLE 2-19
Tailings Impoundment Siting Alternative Summary

Site	Construction Option	Reason Dismissed from Further Consideration	Reference
Rock Creek (MAC Report Site 12)	Not Applicable	Insufficient capacity.	MAC Report (USFS KNF 1986)
Rock Creek (MAC Report Site 11A, ASARCO proposed site)	Downstream Method	Excessive amount of borrow required (40 million cubic yards).	Thompson 1989
Noxon Bench (MAC Report Site 10)	Upstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River.	Thompson 1989
Noxon Bench (MAC Report Site 10)	Downstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River. Excessive amount of borrow required (35 million cubic yards).	Thompson 1989
Swamp Creek (MAC Report Site 21)	Upstream Method	Tailings & reclaim water pipelines twice as long as needed for the Rock Creek site. Disturbance area 200 acres larger than for the Rock Creek site. Site is privately owned and would require removal of residences. No distinct advantages over the Rock Creek Site.	Thompson 1989
Swamp Creek (MAC Report Site 21)	Downstream Method	Same as upstream. Excessive amount of borrow required (10 million cubic yards).	Thompson 1989
Swamp Creek/Rock Creek Combined Site	Downstream Method	Same as for Swamp Creek. Total disturbance area of approximately 700 acres .	Thompson 1989
Noxon Bench/Rock Creek	Downstream Method	Same as for Noxon Bench. Total disturbance area of approximately 700 acres.	Thompson 1989
McKay Creek	Downstream Method	Greater impact to Waters of U.S. and wetlands and diversion of a perennial stream.	Thompson 1989

TABLE 2-20
Tailings Paste Disposal Siting Alternative Summary

Site	Reason Dismissed from Further Consideration	Reference
Rock Creek East (MAC Report Site 12)	Insufficient capacity to contain all tailings material regardless of disposal method.	MAC Report (USFS KNF 1986)
Both Rock Creek Sites (MAC Report Sites 11A & 12)	Increased surface disturbance, increased visual impacts, increased operational costs, increased surface water management needs and monitoring. Need for two paste plants or moving plant from one site to the other or crossing of Rock Creek with high pressure tailings paste line. Would only reduce height of main west-side deposit by approximately 30 feet.	Agency evaluation
Noxon Bench (MAC Report Site 10)	Tailings and reclaim water pipelines crossing the Clark Fork River. Proximity to private residential properties. Need to purchase private property for deposit site.	Thompson 1989 & Agency evaluation
Swamp Creek (MAC Report Site 21)	Tailings and reclaim water pipelines twice as long as needed for the Rock Creek site. Disturbance area 200 acres larger than for the Rock Creek site. Site is privately owned and would require removal of residences. Proximity to other private residential properties. No distinct advantages over the Rock Creek Site.	Thompson 1989 & Agency evaluation
Swamp Creek/Rock Creek Combined Site	Same as for Swamp Creek. Total disturbance area of approximately 700 acres. Need for two paste plants or moving plant from one site to the other.	Thompson 1989
Noxon Bench/Rock Creek	Same as for Noxon Bench. Total disturbance area of approximately 700 acres. Need for two paste plants or moving plant from one site to the other.	Thompson 1989
McKay Creek	Greater impact to Waters of U.S. and wetlands and diversion of a perennial stream. Operational problems due to long distribution lines and numerous pumps or need to construct two or more paste plants or move one plant to more readily reach the entire deposit site.	Thompson 1989 & Agency evaluation
McKay Creek/Rock Creek	Same as for McKay Creek. Paste plants needed in both sites or moved from one to the other. Increased surface disturbance.	Agency evaluation

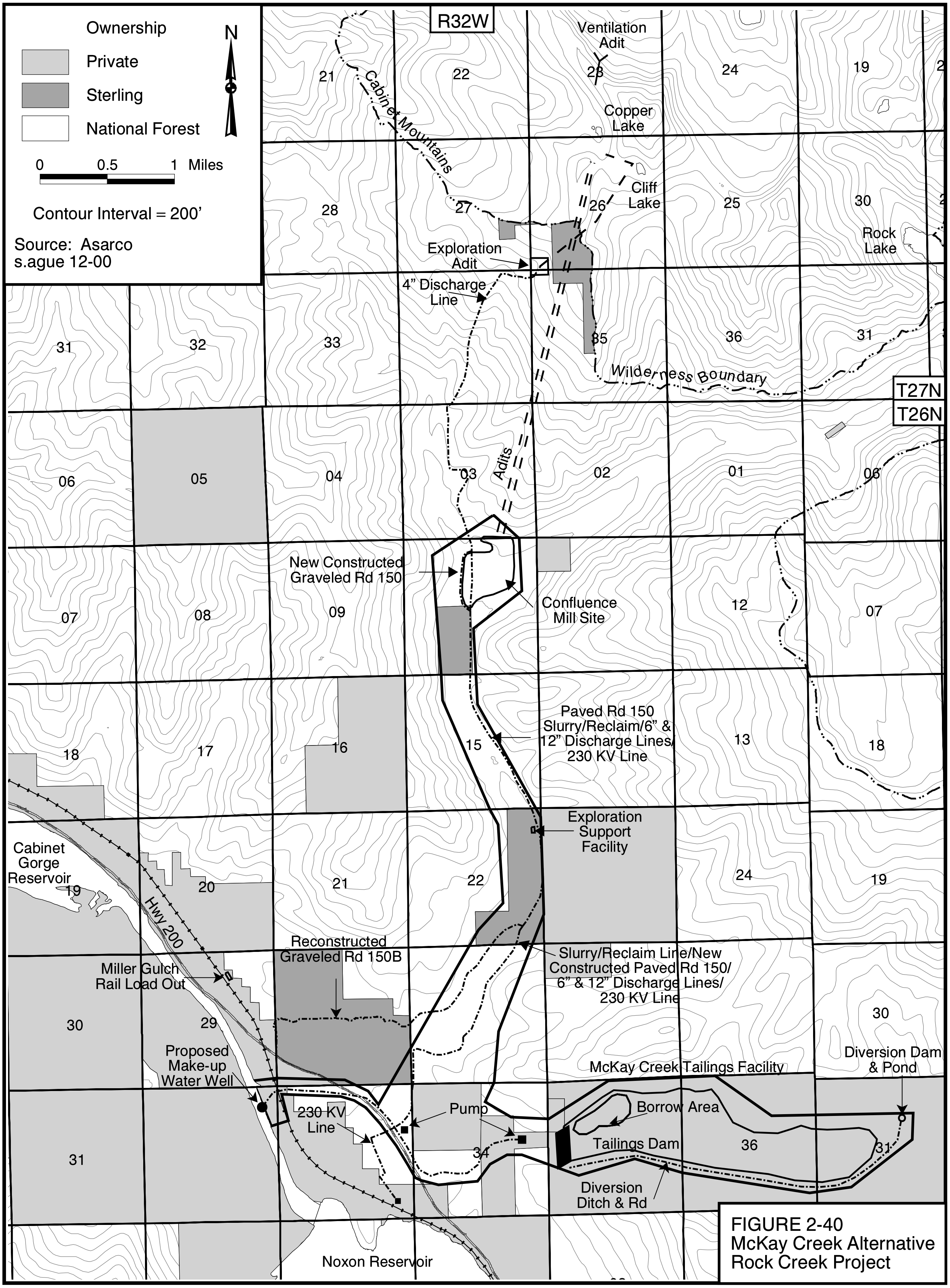


FIGURE 2-40
McKay Creek Alternative
Rock Creek Project

probable maximum flood (PMF) around the south side of the impoundment, would have been required during project operations. Once operations were completed and reclamation had begun, McKay Creek would have been diverted into an engineered streambed on top of the tailings impoundment. It would then have flowed over a concrete spillway and an energy dissipater and finally to a settling pond and the original streambed below.

Reclamation of the impoundment face would not have begun until operations were completed because the downstream method of construction continually adds more tailings on the outside slope as the embankment is built. There would have been enough soil available for salvage to place up to 4 feet of soil on the impoundment (top and embankment).

Environmental Consequences

Under this alternative, impacts associated with construction and operation of mine and mill facilities and roads would have remained. Impacts associated with the Rock Creek impoundment were avoided but replaced by those described below.

The downstream method of construction has some benefits. Less borrow material (the amount cannot be determined at this time) would have been required and thus less possible disturbance of land outside the impoundment footprint. The embankment would have been inherently more resistant to earthquake-induced liquefaction without design modifications such as are described for the Rock Creek impoundment in Alternative III. (If tailings material is properly placed and additional design parameters are incorporated, then any impoundment could be equally stable.) To ensure meeting design specifications, the downstream method of construction requires less testing and operations control than other construction methods.

Storm waters falling in the 7,000-acre drainage basin upstream would channel considerably more water through either the diversion channel or the reconstructed stream than would have been diverted around the Rock Creek impoundment. The Rock Creek impoundment site has an upslope drainage area of approximately 200 acres. The diversion channel and the reconstructed stream would have been sized to handle the flows from the drainage basin. However, because of the larger drainage basin, the consequences of dam failure would have been greater.

Hydrologic impacts to Miller Gulch and Rock Creek from the proposed impoundment would have been shifted to McKay Creek. A lack of baseline data for McKay Creek, however, prevented the development of a quantitative analysis. Impoundment seepage would have either flowed into the ground water and/or discharged into McKay Creek and then into the Clark Fork River. Assuming that seepage quantities and qualities were similar to those estimated for Alternative II, impacts to the Clark Fork River should have been similar. However, since McKay Creek drains into the reservoir above Noxon Rapids Dam, it may have taken longer for impacts from an impoundment failure to move downstream through this slower-moving body of water.

This alternative would have filled in nearly 43 acres of wetlands and non-wetland waters of the U.S. in the McKay Creek drainage. This alternative would have eliminated impacts to wetlands at the Rock Creek impoundment site. If any bull and/or westslope cutthroat trout lived or spawned in the 13,000-foot stretch of McKay Creek directly impacted by the impoundment, then those fish would have been severely affected by the loss of habitat and access to the stream below and above the impoundment. The possible loss of fish could have affected recreational and tribal fishing opportunities within the affected portions of McKay Creek. If there were any pure strains of either species upstream of the impoundment, then the barrier to and from downstream stretches would have helped to isolate and protect those populations.

This impoundment location would have required more road closures by KNF to mitigate impacts to grizzly bears than any of the action alternatives due to its greater disturbance area. The impoundment also would have destroyed more elk wintering grounds than other alternatives. Displacement of game species from the McKay Creek drainage could have affected recreational and tribal hunting opportunities there.

Land that would have been impacted by this impoundment alternative currently is owned by the state of Montana and private timber companies. Sterling would have been required to lease or purchase privately owned lands, and lease, purchase, or persuade DNRC to agree to a land exchange for the state land.

Although this impoundment would not have been visible from Montana Highway 200, it would have been more visible from wilderness trails accessing the CMW (Wanless Lake, Bear Paw, and Goat Ridge trails) as well as from both Goat and Engle peaks than the Rock Creek impoundment. This impoundment would have been more visible from these sensitive areas because it would have been closer to them. Visual impacts would have been adverse, long term, and significant to those recreationists and visitors who valued the existing, natural-appearing landscape in this drainage.

Reasons for Dismissing This Alternative

Although the McKay Creek site did provide the means to construct a downstream impoundment that was not visible from viewpoints in the Clark Fork Valley near Noxon, it created a number of significant negative impacts associated with other identified issues. Therefore, the McKay Creek alternative was dismissed from further consideration for the following reasons:

1. Because tailings impoundments at most sites can be designed and built to meet a certain level of stability, there was no comparable advantage to the downstream method of construction. The Rock Creek impoundment could be further modified to attain the same strengths even though more geotechnical testing and operational controls may be required.

2. This alternative would have impacted the greatest total area (742 acres) compared to Alternatives II through V (i.e., 30 percent more land disturbed than Alternative II).

3 Placing the impoundment in McKay Creek would have generated disturbances in two different perennial drainages as opposed to one for Alternatives II, III, IV, and V.

4. There would have been severe, long-term impacts to aquatics/fisheries resources due to the elimination of a large amount of stream habitat. There also would have been increased water temperatures, and increased sedimentation due to the diversion and stream reconstruction.

5. This alternative would have affected the greatest amount of wetlands and non-wetland waters of the U.S. (43 acres). It is a 404(b)(1) requirement that the selected permitted

alternative be the least damaging practicable alternative. It is therefore unlikely that COE would approve a 404(b)(1) permit for this alternative. It is also unlikely that DEQ would issue a 401 certification for the 404(b)(1) permit. This is based on section 75-5-605(1)(a), MCA, which makes it illegal to place or cause to be placed any waste in a location where it is likely to cause pollution of state waters. Wastes include any substance produced or disposed of from natural resource development, including mining. It is also departmental policy not to permit tailings impoundments in a drainage other than headwater locations.

6. This impoundment would have required perpetual maintenance of the spillway and stream channel to prevent erosion near the dam and potential erosion of the embankment, leading to potential impoundment failure.

7. Impoundment failure during a PMF likely would have sent flood waters and some tailings downstream into Noxon Reservoir.

8. This impoundment probably would have been a high hazard facility according to Montana's Dam Stability Act and would have required permitting by DNRC after bond release.

9. While visual impacts to people using Montana Highway 200, recreating at Noxon Reservoir, and living in the Clark Fork Valley would have been mitigated, this alternative would create a significant, long-term visual impact to recreationists in McKay Creek drainage.

McKay Creek Water Retention Dam

The 404(b)(1) permitting process requires mitigation for wetlands and non-wetland waters of the U.S. that would be impacted by construction of a tailings impoundment in McKay Creek. The use of a water retention dam to create a hydrologic regime capable of supporting constructed wetlands was considered but dismissed for the following reasons.

1. An entire water retention dam would have to have been designed and built prior to placement of tailings rather than starter dams and a staged embankment.

2. Such a dam would require more expense, would be more massive, and might necessitate transport of construction materials from off site, resulting in a structure similar to a conventional reservoir dam. This would probably classify the dam as a "high hazard dam" subject to the requirements of the Montana Dam Safety Act once the impoundment had been reclaimed according to an approved permit reclamation plan.

3. Stored tailings would have remained thoroughly saturated and therefore more liquefiable material, increasing the risk of downstream damage if the dam had failed. In comparison, tailings behind a staged embankment would have a decreased risk of downstream movement and associated damage as they dewatered and became more stable over time.

4. The ability of the site and materials to maintain the hydrologic balance necessary to support wetlands was uncertain. Factors that could play a role include the amount of streamflow in McKay Creek, permeability of underlying bedrock and alluvium, and precipitation.

5. Replacement wetlands could not be constructed on top of the impoundment until after mining operations had ceased and the impoundment could be reclaimed. COE prefers to have replacement wetlands constructed prior to destruction or filling in of existing wetlands.

Other Tailings Disposal Methods

The Agencies also considered and dismissed: (1) dry tailings, (2) conventional backfilling of tailings into the mine, and (3) paste backfilling of tailings. Following release of the draft EIS, ASARCO provided additional information on methods of transporting tailings from the surface to the underground mine and disposal through out the mine. These methods mostly centered around the disposal of tailings using recently developed paste handling technologies (Golder Associates 1996) but also included conveyor transport of dry tailings into the mine.

Dry Tailings

The term "dry" tailings is somewhat misleading. The tailings are not actually dry; they are dewatered to the point that they can be handled mechanically and placed at a disposal site as a moist material rather than a hydraulically placed slurry. Effective dry tailings circuits commonly achieve moisture contents in a range of 17-18 percent. This technology has emerged over the last decade and is used in the metal mining industry primarily in the disposal of tailings from smaller gold mining operations. This method was used at Mineral Hill mine at Jardine, Montana, and has been proposed at the Diamond Hill mine near Townsend, Montana.

Dewatering could take place at either of two locations depending on the method of conveying the tailings to the disposal site. If dewatered at the mill site, tailings would be too dense to pump and would need to be conveyed to the tailings disposal site by some mechanical method. Alternatively, the slurry could be pumped from the proposed mill and then dewatered at the tailings disposal site. Water generated from this process would need to be captured for reuse or treatment. Moist tailings are mechanically placed using conventional earthmoving methods (i.e., trucks, conveyors, stackers, bulldozers) to construct an earthen fill. Such a fill may, depending on specific engineering properties of the tailings and disposal location, be retained behind a dam, be self-supporting, or a combination of the two.

The existing filtration methods for creating dry tailings have only been proven to be economical for small-scale operations on the order of hundreds of tons of tailings per day. The proposed project would process approximately 10,000 tons per day of tailings.

The Agencies do not consider this to be a viable tailings disposal alternative for the following reasons:

- technical and operational difficulties that could result from having to mechanically handle large quantities of tailings;

- probable need for a backup wet tailings storage; and
- increased capital and operating costs.

Conventional Backfilling of Tailings

The Agencies conducted an analysis to determine whether tailings could be backfilled into the mine and whether backfilling would reduce the amount of disturbance associated with the tailings surface disposal. The placement of tailings in underground mines is common practice in the precious metal mining industry. Its primary purpose is to provide physical support of the underground openings to allow continued mining rather than to provide tailings disposal. The critical question for this project is whether backfilling could both technically and economically allow for the elimination or significant reduction in the size of a surface tailings impoundment.

Sands. Historically, backfilling with tailings was used in underground mines that followed narrow, vertically oriented mineral veins rather than the thick, flat-lying ore zones of the proposed project. The sand fraction (sands), separated from the silt- and clay-sized (slimes) portion of the material, would be pumped in a water slurry to the underground mine openings (stopes). The sands allowed the water to freely drain and then settled into a compact mass in the stope. This sand-fill both supported the walls of the stope and provided a working floor for the miners to proceed with extraction of vertically oriented ore veins.

A further development of the sand-fill technology was the addition of cementing agents, usually portland cement, to the sand-fill to create a weak concrete. This resulted in a stronger backfill material and allowed for the mining of narrow vertical stopes surrounded by very weak rock. This method of cemented sand-fill also found use in the mining of thick horizontal ore zones, similar to those of the proposed project. Initial support of the stope roof (back) was supplied by leaving wide pillars of ore. Filling open stopes with cemented sand-fill allowed subsequent recovery of these ore pillars due to the support provided by the cemented sand-fill. In this manner, ore recovery would be greater than that obtained by using pillars for ground support.

Using the sand fraction as backfill leaves the slimes portion to be disposed. Based on estimates from the milling process at the Troy Mine, approximately 60 percent of the tailings from this project would be slimes (Dames and Moore 1993). Thus, if sand-filling was used, only about 40 percent of the tailings would be placed in the underground openings as part of the mining procedure; the remaining 60 percent would be disposed of in another way, and most likely in a surface impoundment.

Safe disposal of fine-grained slimes in a surface impoundment requires construction of a retention dam. Since the bulk of the sand portion in tailings typically is used to construct an embankment, alternate construction material would be needed to build the dam should the sand fraction be returned underground as part of a backfilling scheme. Despite the reduction in volume of material to be disposed of on the surface, the overall size of the retention dam and the retained slimes would still approximate that of the proposed impoundment because of the topography and basin geometry of the proposed impoundment site. In addition, substitute embankment construction material, equal in volume to the sands initially proposed for construction, would need to be identified. Depending on the height of each incremental embankment raise, the total substitute volume needs could be as high as 40 million cubic yards. Therefore, use of sand-fill would not appreciably affect the footprint of the tailings impoundment, yet would require an additional disturbance area to supply construction material for a slimes retention dam.

Slimes. Disposal of the separate slimes fraction in the underground mine would require creation of additional space by removal of the ore pillars and use of substantial bulkheads constructed to contain the slimes in the stopes between the cemented sand-fill pillars. Based on discussions with specialists from the U.S. Bureau of Mines (pers. comm. Ron Backer, Dave Denton, Douglas Bolstad, and Richard Grabowski, U.S. Bureau of Mines, July 21, 1994) this method of tailings disposal is not practiced in the mining industry, is not a proven technology, and is not likely to be economically viable as a tailings disposal method.

Unsegregated Tailings. Sand-fill, as a potential tailings disposal alternative, generates the need to dispose of the slimes fraction apart from the sand. The mining industry and government agencies have conducted research into whether to use both sand and slimes (whole tailings) as backfill. Ongoing research in the use of whole tailings for backfill is now beginning to move into industrial-scale applications. However, to date, whole tailings backfill at the scale of the proposed project is limited to applications requiring cemented backfill for underground support and is integral to the economics of the mining method necessary for recovery of the ore (pers. comm. Lani Boldt, U.S. Bureau of Mines, June 5, 1993; pers. comm. Jim Vickery, Kennicott Copper Company, June 5, 1993). This form of underground support is not necessary for the proposed project and this technology is not proven as an economic tailings disposal method for room-and-pillar mining.

The most significant factor limiting backfilling is that most of the tailings cannot fit in the underground space due to the increased volume resulting from grinding the ore. At Noranda's Montanore Project for example, testing indicated over a two-fold volume increase (U.S. Forest Service et al. 1992: p.104). Therefore, even if backfilling were used, a surface impoundment would still be needed to accommodate the surplus tailings from the milling process. The size of this impoundment would be dictated by the volume of tailings which could actually be returned underground. Given the present impoundment location and its topography, if 50 percent of the whole tailings could be stored underground, the embankment height would be reduced by about 135 feet, while the surface footprint would be decreased by approximately 20 acres. This decrease in size would be primarily along the north edge of the impoundment.

Underground storage of cemented tailings (backfilling) could provide potential benefits by:

- partially reducing the size of the required surface impoundment;
- reducing the risk of surface subsidence -- providing underground support in areas not presently designated for artificial supports beyond the designed pillar layout; and
- allowing increased ore recovery when substituted for the unmined support pillars.

Backfilling was dismissed from further consideration for the following reasons.

- A surface impoundment could not be eliminated or significantly reduced in size.
- Designated embankment construction materials would require development of an alternate material source and accompanying disturbance area.

- Backfilling with whole tailings is not a proven technology at the scale (production rate and volumes) of the proposed project. The vast majority of backfilling operations occur at precious metals mines where the economics are more favorable. The operating costs per ton of ore mined would be too high for a base metal operation like Rock Creek. Based on a review of a sampling of existing mines using various forms of cemented backfill, costs have ranged from a low of approximately $7/ton to over $18/ton; metals value per ton of ore at Rock Creek average $25/ton based on current spot market prices. When other operating and capital costs are factored in, the cost to produce a ton of ore could be uneconomical if backfilling were part of the program. Conversely, the cost of surface tailings impoundment disposal averages between $0.80 and $2.50/ton (Hutchison and Ellison 1992).

Paste Backfilling of Tailings

Surface paste disposal is essentially a modification of the dry tailings disposal method. For more detailed information regarding paste tailings production and handling refer to the paste tailings discussion under the Alternative V description in Chapter 2. Potential benefits and several potential paste backfill transport and handling methods, as well as the Agencies' rationale for dismissing these alternatives are provided in the following text.

Potential Benefits

Decreased surface disturbance. As with the other backfilling methods, there are a number of reasons why paste backfill would not allow for all of the tailings to be placed underground. The most important consideration is that rock expands in volume when crushed. Rock Creek deposit ore expands by a factor of 1.67 when crushed to extract copper and silver minerals. That is, one ton of undisturbed ore would have a volume of about 12 cubic feet but processed rock (tailings) would expand to a volume of approximately 20 cubic feet (when rock is ground to small particles, the relative proportion of air space between particles increases - effectively expanding the amount of space a given amount of material requires). Additionally, portions of the mine workings would have to remain open for the entire life of the mine. These include access and air intake ventilation adits, transportation and airway corridors, material processing areas, and other underground facilities. When all of these factors are considered, no more than 40 percent of the tailings could physically be returned to the mine. The remaining 60 percent would need to be stored on the surface.

The remaining 60 percent of the tailings would obviously take up less surface space than would the 100 percent surface deposition alternatives. If paste backfilling were implemented to the maximum extent feasible, the height would be reduced by approximately 100 feet, and the surface disturbance of the tailings facility would be reduced by approximately 20 acres. Due to the topography of the site, most of the acreage reduction would be along the upper north slope of the site. The overall foot print of the tailings facility would not change dramatically.

Increased ore recovery. Paste backfill could improve the strength of the pillars left in place and could allow the removal of some, but not all, of the pillars, thus improving ore recovery. The strength of the backfill material would dictate if pillars could be removed, how many pillars could be removed, and from which areas pillars could be removed. This would be important should Sterling wish to remove pillars at the close of the project. However, the applicant states that pillar removal is not economically feasible and has made a commitment not to rob pillars at the end of mining. Current rock mechanics studies indicate that the risk of subsidence is remote (see Appendix G for more discussion on subsidence). Paste backfilling for subsidence control is not considered a reasonable requirement given the proposed mine plan (which includes the commitment not to remove pillars) and the strength of the surrounding rock.

Decreased mine water inflow. The permeability of the tailings paste would be sufficiently low that water flow through the backfill would be minimal. However, there would still be the possibility of water flow along the paste backfill/rock wall interface (Golder Associates 1996). Grouting of the rock face would provide a more effective means of reducing ground water inflow than paste backfilling; the applicant has included grouting for ground water control in its application. Requiring paste backfilling for ground water control would be a less effective and more costly procedure to achieve this goal than other conventional methods.

Paste Backfilling Transport and Handling Methods

Paste backfilling with whole tailings or a segregated portion of tailings that meets the particle size distribution criteria needed to create paste (fine particle content of at least 15 percent by weight less than 20 microns in size) has been evolving for the past two decades in Germany, South Africa, Canada, and Idaho.[21] Testing by the applicant has shown that the proposed Rock Creek project mill grind will produce tailings with the qualities necessary to make paste. Paste production involves dewatering the tailings to approximately 20 percent by weight. Paste has unique behavioral properties which allow it to be handled in pipelines under conditions not possible using traditional slurry pipeline transport. Since it is nonsegregating when allowed to rest, it can be transported to a placement site without the typical solids settlement problems often associated with slurries. The paste production process also allows for the mixing of additives such as Portland cement or fly ash, materials which can increase the strength and durability of the tailings paste material.

Paste backfill systems are most effective and economic when they take advantage of gravity feed from a mill located above and in close proximity to the ore body. The mill at the confluence of the east and west forks of Rock Creek (Alternatives IV and V) would be approximately 3 miles away from the ore body at a 12 percent gradient - well below and laterally distant from the ore body. The analysis of paste backfill for the Rock Creek project required investigation into two methods of transporting the paste into the mine (paste pumping, and slurry pumping) as well as the concept of operating an underground mill and paste plant to entirely avoid the uphill transportation requirement.

A description of these three methods follows along with the rationale for the Agencies' dismissal of these methods.

Surface paste plant and paste pumping. Transporting the paste via a pipeline was considered because of the paste's characteristics described above. This method would require a high pressure pipeline from the mill to the mine and then to the different mined out areas to be backfilled. The positive displacement pumps required are limited to pumping 3,000 to 4,000 feet per single pump at a flow of 100

[21] Mines where paste has been used include: Bad Grund Mine in Preussag, Germany; several South African mines; Inco's mines in Sudbury, Ontario, Canada (including the Garson Mine); and Hecla Mining Company's Lucky Friday Mine in north Idaho (Golder Associates, 1996). Paste is used at these mines as a backfill medium where adverse ground conditions require the use of fill to stabilize underground mine workings or, when found to be cost effective, to assist in maximizing ore extraction.

tons per hour. Because of the maintenance requirements and the problems that could occur with pump break downs, there would need to be duplicate backup pumps at each pumping station. There have been problems with positive displacement pumps in underground mines with long horizontal distances, such that some gold mines in South Africa abandoned tailings paste backfill for high-density slurry backfill (Golder Associates 1996). The Rock Creek project would not only have a long horizontal distance problem to overcome. In addition there would be a 3 mile long uphill grade to pump the tailings paste before reaching the mine. Then there would be a relatively long distance (up to 1.5 miles) and varying grade to reach the farthest corners of the mine areas. This method was eliminated from consideration because of the operational concerns and because this type of system would not be capable of pumping the required 4,000 tons of tailings paste per day from the mill into the mine.

Slurry pumping and underground paste plant. This method would require pumping the tailings from the mill up gradient to the mine vial a series of slurry pumps. Backup pumps would be required as slurries tend to separate into a dense tailings layer and free flowing water when movement of slurry is halted. Restarting the flow of tailings slurry would be difficult or impossible, possibly requiring a back flush of the entire pipeline prior to restarting. There would need to be an underground paste plant and high pressure pipeline distribution system constructed to make the paste and transport it to the mined areas. Slurry tailings backfill placement would not be feasible for these reasons. Water removed from the slurry when dewatered to paste consistency would need to be returned to the mill for reuse as processed water via a separate pipeline. It could not be commingled with mine drainage that would be sent to the waste water treatment plant for discharge to the Clark Fork River. This method was eliminated from consideration because of operational concerns.

Underground mill and paste plant. The previous three methods dealt with the need to transport tailings from the mill, up into the mine. The 3 mile, 12 percent (Alternative IV) gradient pipeline or conveyor transport requirement was considered to be one of the primary problems. An underground mill located near the primary crusher would eliminate that problem.

There would be reduced ore transportation systems and reduced surface disturbance at the confluence mill site. Three major problems would reduce the feasibility of an underground mill. The first relates to project development. The mill space would need to be excavated into waste rock and built before any ore processing could begin. Any ore above it or in the vicinity of the mill would need to be transported out of the mine and stored until the mill was operational; then the ore would need to be transported back up the adit to the mill. Second, the majority of the waste rock from driving the adits has been proposed for use in creating the mill site pad in Alternatives IV and V. Under the underground mill concept there would be considerably less embankment needs. This excess material would either need to be disposed of in a waste rock pile in the vicinity of the mine portal and the abandoned surface mill site or hauled down to the tailings disposal site for use in constructing the embankment for an impoundment, key buttress for a paste deposit, or burial under the tailings in the body of the tailings disposal facility, depending upon the method of surface disposal being used and thus increasing the volume of material stored there. The last item of concern deals with the need to get sufficient electrical power to the underground mill. The large electrical lines would require sufficient clearance for safety reasons which might require larger adits resulting in additional waste rock to be disposed of. Power could be supplied, however, the system would be extremely costly and could pose a safety hazard to miners who would be sharing a confined area (adit) with high voltage lines. The primary reasons for eliminating this type of facility to achieve paste backfilling are the concerns about stockpiled ore on the surface during development, increased visual impacts from disposal of larger volumes of waste rock, and operational considerations. This facility would also require an underground paste plant and pipeline distribution system with problems as described above.

Conveyor Transport of Dry Tailings Backfill

Conveyor transport does not take advantage of paste technology. Instead, it depends on drying tailings to a moisture content in the range of 17 to 18 percent at which point they do not flow. This method would take advantage of the return belt of the ore transporting conveyor. The tailings would need to be dried to a filter cake at the mill, loaded onto the return side of the main conveyor, transferred to an underground surge bin, and then transported to the mined out workings via trucks. This method requires additional facilities at the mill site for dewatering 4,000 tons of tailings per day. This may result in additional disturbances at the mill site and would require additional capital costs and manpower to build and operate this facility. The primary reason why the conveyor transport would not be feasible is the operational aspect of operating a dedicated fleet of trucks to transport the tailings from the underground surge bin to the mined-out workings. There would be additional requirements for ventilation as there could be as many as 16 to 20 trucks in operation of ore hauling and backfilling. Traffic congestion within the mine would be a major problem, especially early in mine life when there is less maneuvering room available. In addition to operational factors and health and safety concerns, which are the primary reasons for eliminating this method of transportation, there would be additional capital and operational costs to the company to acquire, operate, and maintain the fleet of trucks, and employ the additional drivers.

Lined Tailings Facility

As a result of comments received in response to the draft EIS, a report (Dames & Moore 1996) was prepared examining lined impoundment options using both natural and synthetic materials. The conclusion of the report indicated that the reduction in seepage through the bottom of the impoundment was less than an order of magnitude between the lined and unlined cases. This conclusion was in part based on the inherent low hydraulic conductivity of the tailings slimes providing a natural barrier to seepage. Conversely, the installation process for synthetic liners or other manufactured products can introduce construction error which can translate into higher than expected seepage rates through otherwise very "tight" material. Although there was a demonstrated reduction in seepage volume when using a liner, the degradation of water quality in violation of water quality laws was not predicted even when no liner was assumed. Referencing the draft MPDES permit, the analysis indicated that the mitigations of pumpback wells which were introduced as part of Alternatives III and IV were sufficient to decrease the concentrations of nitrate and metals (after mixing) emanating from the impoundment to justify finding the discharge "nonsignificant." The Agencies decided that the MPDES analysis demonstrated that a lined impoundment was not necessary to maintain water quality. While lined impoundments are customarily used in conjunction with toxic effluents such as cyanide or heavy metals, the projected chemical concentration and signature of the Rock Creek tailings effluent did not warrant the use of a lined waste facility.

The Dames & Moore report also included cost projections for the different lined options. These cost estimates ranged from a low of $3.4 million for the impoundment as proposed by the applicant to a high of $29.6 million for a synthetically lined impoundment. While cost alone is not a criterion to dictate alternatives development, when looking at the cost in comparison to the net benefit in environmental protection from lining the impoundment, the Agencies determined that there would not be an appreciable gain in benefit from this option.

Rail Siding (Loadout) Alternatives

As discussed in Alternatives Description, the applicant proposes to haul copper/silver concentrates produced at the mill by truck to the existing Hereford railroad siding 3 miles north of Noxon adjacent to Montana Highway 200. A covered tractor-trailer combination would haul concentrates to a newly constructed loadout facility between 8 a.m. and midnight, 7 days a week. Transporting the estimated 51,000 tons of concentrate produced annually would require about eight round trips per day.

In consultation with the shipping railroad, Montana Rail Link (MRL), the Agencies developed the following alternatives to find a rail siding location that would limit or eliminate the amount of time and miles concentrate trucks would be on Montana Highway 200 (MRL 1994a, MRL 1994b, pers. comm. MRL representative with Tom Grabinski, May 28, 1994). The Agencies also considered proximity to dwellings as noise and lights could affect persons living nearly.

Rock Creek Rail Spur

No highway access would be necessary for this alternative. Access would be via a new road connecting FDR No. 1022 and new FDR No. 150. The combined 13,000 feet of new access road and track would cost about $800,000 to $1 million. The Rock Creek Spur alternative was dismissed because it would be too cost. In addition, MRL prefers not to build dead-end spurs (see Figure 2-41).

Noxon Rapids Dam South

The Noxon Rapids Dam South rail siding alternative would require some additional road construction. The existing road intersection with Montana Highway 200 does not meet MDT criteria for sight distance. An alternative would be to construct the Montana Highway 200 intersection immediately across from the FDR No. 150 intersection. Such an intersection would preclude ore trucks from having to pull onto the highway and then exit 0.25 mile away. About 1,500 feet of road would need to be constructed from Montana Highway 200. Then about 800 feet of existing road, Noxon Dam Road, and the Montana Highway 200 intersection would be obliterated. A 0.25-mile segment of new road would have to be constructed to access this siding location. Either side of the main line could be used for rail siding. About 1,200 feet of track would have to be constructed, at a cost of $200,000 (see Figure 2-41).

The Noxon Rapids Dam South alternative was dismissed because the access to it uses the Avista Corporation's (formerly Washington Water Power) road and passes immediately adjacent to their barracks. It is also within 200 yards of the reservoir, a potential problem in the case of a spill.

Noxon Rapids Dam North

Access to this site would be from new FDR No. 150 and north onto Montana Highway 200 about 0.5 mile. Trucks hauling concentrate from the mine would have to turn left (west) onto an unnumbered road paralleling the south side of Rock Creek, leading to the rail siding. About 1,200 feet of track would have to be constructed, at a cost of $200,000 (see Figure 2-41).

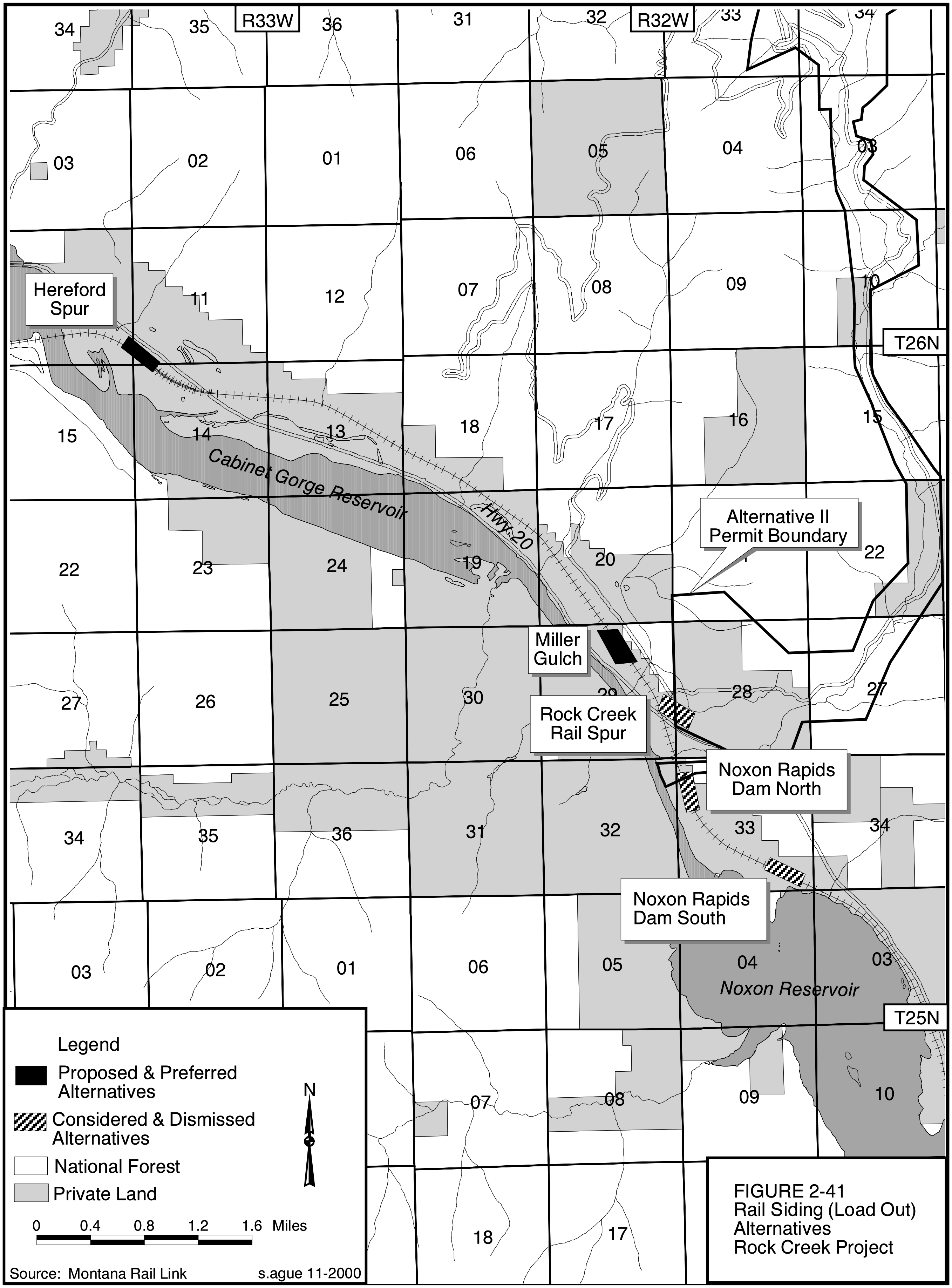


FIGURE 2-41
Rail Siding (Load Out)
Alternatives
Rock Creek Project

The Agencies dismissed this alternative because it would increase congestion on Montana Highway 200 and decrease safety more than the project proposal. Concentrate trucks would not reach designated highway speeds before trucks would need to slow down to make left-hand turns. The alternative is also in close proximity to Avista Corporation's barracks. MRL stated that this was not a feasible site due to railroad alignment.

Combined Operations (Rock Creek and Montanore Projects)

During the EIS scoping process and project review processes, including meetings with cooperating agencies, the Agencies identified a potential alternative of combining the Rock Creek project with Noranda's approved but not yet constructed Montanore mine project. The Agencies explored the possibility that combining the mining operations might diminish the overall impacts of both projects. There are a large number of possible combined operation scenarios that might be considered. However, this analysis focuses on two. Under this analysis, the two companies would mine their ore bodies through the approved Montanore adits and use the Montanore mill site. The companies would either mine the two ore deposits sequentially, thus extending the mine life over a 45-year period, or they would mine the two ore bodies simultaneously over a 15-to-30-year life. Under either of these scenarios, the Agencies' analysis is based on Sterling and Noranda operating their projects essentially as a joint venture, using one operator, and utilizing those elements of the Montanore project that were previously permitted. They would also use elements of the Rock Creek proposal that would be necessary to make a logical and efficient mine operation.

The Agencies believe that the efficiencies that might be achieved under a combined operation would likely be logical and provide for a more cost efficient operation as compared to two separate operations. However, as discussed below, overall impacts may not actually be diminished over those of two separate operations.

The Agencies have determined that they do not have authority to require Sterling and Noranda to join their proposals into one operation. The Agencies acknowledge that once the Rock Creek project is permitted (should an action alternative be selected) Sterling and Noranda could propose to combine their operations. Should the companies decide at a later date to operate jointly, that proposal would be subject to NEPA requirements.

Sequential Operation

To analyze sequential mining of the two ore deposits, the Agencies made the following assumptions:

- That Sterling could be required to operate jointly with Noranda and that Noranda could be required to operate jointly with Sterling. (Note: Sterling and Noranda are on record as stating they do not wish to combine their operations a this time [Sterling 2001]. Therefore, these two elements are essential in requiring a combined operation. The Agencies have determined that they do not have the authority to require a joint operation.)

- The most efficient mining operation would be for one operator to mine the deposits and process the ore using Noranda's planned mill in Ramsey Creek.

- Noranda's issued federal and state permits/approvals could legally be revoked in favor of a new alternative that requires that Noranda and Sterling combine their operation, or Noranda's permits remain, but would be modified to include developments necessary to process Sterling's ore. (The Hard Rock Mining Act and Forest Service specify very limited reasons for revoking permits and plans of operation. Therefore, revocation would be highly unlikely.)

- Noranda would mine their Montanore (Rock Lake) deposit first as approved in 1993.

- Noranda's Rock Lake deposit would be mined and the mined-out workings would be available for permanent storage of a portion of the tailings generated from mining the Rock Creek deposit.

- The evaluation adit, as proposed by Sterling would be constructed to evaluate the Rock Creek deposit to obtain rock mechanics data to aid in underground mine design, and to obtain a bulk ore sample for metallurgical testing.

- Noranda's currently permitted Little Cherry Creek tailings storage site would be utilized as planned for tailings generated from the mining of the Montanore deposit. Its design capacity is 120 percent of Montanore project requirements. It would therefore be capable of storing about 20 million tons of tailings from the Rock Creek deposit.

- The combined project's second tailings facility (assuming industry standard design criteria for impoundments) would have had the following characteristics. Dam height - 430 feet, crest length - 3,700 feet, impoundment area - 280 acres, volume of starter dam - 4.2 million cubic yards, volume of dam - 28 million cubic yards, realign road - 9,700 feet, Midas Creek watershed above dam - 2,430 acres, two diversion dams and channels required, length of diversion channels - 23,000 feet.

- Sterling's proposed wilderness intake ventilation portal would be necessary to adequately ventilate underground workings. Presently, the adit is planned late in mine life and would be constructed as ventilation requirements dictate.

Some years prior to exhausting the Montanore deposit, the operator would drive the Rock Creek evaluation adit. Assuming favorable evaluation results, construction would begin on two parallel adits each about 25 feet wide by 20 feet high for a distance of about 24,000 feet to connect the Ramsey Creek mill to the Rock Creek deposit primary crusher location. This construction would create approximately 2 million tons of waste rock. At this point in the operation, Noranda's Little Cherry Creek tailings impoundment would have nearly reached capacity and construction would start on another impoundment, probably in Midas Creek.

A primary advantage of using a sequential joint operation would be the ability to use the Montanore mined out underground workings for storing a portion of Rock Creek deposit tailings. In addition, the Montanore workings would decline continuously to the northwest allowing for relatively easy downhill transport of paste tailings. The lower portion of the Montanore underground opening could contain about 30 percent of the Rock Creek deposit tailings. The Agencies only considered using the lower mine workings for backfilling because use of upper workings would require sealing mine workings which would create long-term failure risks and would require the construction of an additional adit. The upper portion of the Montanore opening and the Rock Creek underground opening is not contemplated for storage of backfilled tailings for reasons that are described in Appendix G, Tailings Disposal Alternatives. Mine workings from mining the Rock Creek deposit could also be backfilled but with only a small portion of the whole tailings. It was estimated that only 20 percent (8.9 million cubic yards) of the mine workings would be acceptable for backfilling tailings. The capacity of the lower Montanore workings is about 26.7 million cubic yards. It was estimated that about 35.6 million cubic yards of tailings could be backfilled into the Montanore and Rock Creek mine workings.

Sterling's Rock Creek project is estimated to create up to 100 million tons of tailings that would require permanent storage. This analysis presumes that approximately 20 percent would be stored in the Little Cherry Creek tailings impoundment and 35 percent would be stored in the Montanore underground opening. The remaining 45 percent, or around 45 million tons, would require an additional impoundment site. The most likely site would be Midas Creek, one of several analyzed in the Montanore EIS.

The advantages associated with this alternative would be the use of one mill and associated facilities for both operations. Except for Sterling's evaluation adit, only the east side of the Cabinet Mountains would be disturbed; impacts to resources in the Rock Creek drainage would be avoided. Additionally, cumulative grizzly bear impacts (Montanore plus Rock Creek) would be reduced.

Under this alternative, the impacts of the surface storage of tailings at Midas Creek would likely be greater than those using the Rock Creek tailings impoundment site for the following reasons:

- Though the Midas Creek impoundment would be smaller in acres, the dam would be up to 105 feet higher and require the diversion of two perennial streams (up to 2.4 miles or 200 acres of stream disturbance).

- Six and one-half acres of wetlands would be destroyed by the Midas Creek impoundment, which is about equal to the total acres that would be impacted by the Rock Creek proposal.

- Two hundred and six acres more of old growth would be impacted.

- Ten million cubic yards would be excavated to create the diversion channels.

Though there are some advantages to this alternative, the Agencies find that they are outweighed by the disadvantages. Regardless of which side of the mountain is used for milling the Rock Creek deposit, a second tailings impoundment would be necessary. Underground storage of the total volume of tailings is not possible. The combined operations would impact approximately 80 more acres than would two separate operations. Two diversion channels totaling 23,000 feet would be needed to divert Midas Creek and a tributary. The same amount of wetlands and non-wetland waters of the U.S. would be affected by either alternative. Significantly more old growth ecosystem would be impacted by using the Midas Creek impoundment. Bull trout concerns in Midas Creek would be very difficult to mitigate. In addition to the environmental and engineering reasons for dismissing this alternative, there are significant timing and legal issues associated with requiring two corporations to work together.

Simultaneous Operation

Another option would be to mine the two ore bodies simultaneously using Montanore's previously permitted Ramsey Creek mill site on the east side of the mountain. Under this option, the Agencies assumed companies would operate at their proposed rates: 10,000 tons per day for about 30 years for Sterling and 20,000 tons per day for 16 years for Noranda. This would necessitate the excavation of two 24,000 foot adits that would connect Sterling's proposed crusher site with Noranda's mill. This would be in addition to the three adits proposed in Noranda's approved plan of operation. Either an additional mill would need to be constructed or the proposed mill expanded to handle the 30,000 tons-per-day of ore. By mining simultaneously, two tailings impoundments capable of handling a total of 180 to 200 million tons of tailings plus the associated roads and slurry/reclaim lines would need to be constructed. Underground tailings backfill would not be part of a simultaneous operation alternative. A larger tailings impoundment in Midas Creek would be constructed in addition to Montanore's approved Little Cherry Creek tailings impoundment. The transmission line may be capable of carrying the additional load, but a detailed analysis would be necessary to make a final determination.

This option does not offer any significant environmental advantages over Sterling's proposal and would have more impacts than those under the sequential operation alternative. In addition to the environmental and engineering reasons for dismissing this alternative, there are significant timing, legal, and liability issues associated with requiring two corporations to work together. For these reasons, this option was dismissed from further study.

Other Water Treatment Methods

Water treatment alternatives that were considered and dismissed by the Agencies include: (1) land application disposal (LAD) of excess mine adit discharge and mill process water, (2) constructed wetlands, and (3) conventional suspended growth nitrification/denitrification treatment. The LAD alternative consists of several disposal options including percolation ponds, drip irrigation, and spray irrigation. The constructed wetlands option consists of wetland cells, ponds, and a meadow. Conventional suspended growth nitrification/denitrification treatment may require two separate treatment steps to reduce dissolved nitrogen. The rationale for dismissing each option is provided below.

Land Application Disposal

Percolation Ponds. Potential sites for percolation ponds or infiltration galleries were identified on about 100 acres of the Clark Fork River gravel terraces, and on 15 acres of Rock Creek alluvial deposits. These sites were selected because of their ability to transmit large volumes of water. It was estimated up to 1,700 gpm of excess water could be disposed of in a series of percolation ponds. The use of percolation ponds would be restricted by severe winter weather conditions for at least part of the year.

The use of percolation ponds was dismissed as a primary alternative for disposing of excess mine and process water for several reasons. The use of percolation ponds on gravel terraces or alluvial deposits would likely result in the formation of springs and seeps that would directly discharge into Rock Creek and the Clark Fork River. Springs and seeps could cause erosion and increased sediment loading to the receiving streams. In addition, the percolation ponds would have little effect on the initial quality of the discharge. Sterling estimated that the maximum removal efficiency for nitrate and ammonia that they could obtain using a combination of percolation, infiltration, and spray or drip irrigation was 20 percent. The potential would exist to affect ground water quality and existing beneficial uses of ground water.

Drip or Spray Irrigation. Two irrigation sites were identified for disposal of excess water by either drip or spray irrigation. One site consists of approximately 160 acres and is located on a hill to the northeast of the proposed tailings impoundment. The other site consists of about 225 acres located north of Montana Highway 200 between Rock and McKay creeks. Up to 800 gpm could be disposed at the two irrigation sites, less than half of the average anticipated discharge during operation. Relatively large areas of land would be disturbed, and the cost of maintenance would be high.

Drip or spray irrigation could be used only for about 150 days of the year; freezing, precipitation, and saturated soil would reduce soil infiltration capacities, hampering operations the remaining 215 days. Spray or drip irrigation by itself could remove a larger percentage of nitrogen (up to 80 percent) if the volume to be treated was much lower or there was adequate land available. Based on these considerations, the use of drip or spray irrigation was dismissed from further consideration as a primary means of wastewater treatment.

Constructed Wetlands

Constructed wetlands treatment consists of a primary sedimentation basin, wetland treatment cells, shallow pond, and wet meadow. The critical design criterion for sizing the components of a constructed wetlands is the hydraulic residence time (HRT): the total time that water remains in the treatment cells prior to discharge. Based on typical HRTs of 5 to 7 days to achieve 80 percent treatment (primarily denitrification), the required area for the wetland cells was calculated to be approximately 100 acres. Furthermore, additional area would be required for the sedimentation basin, shallow pond, and wet meadow. Based on preliminary calculations, the constructed wetlands treatment option was dismissed because adequate land area within the proposed permit area does not exist. There is also the possibility that the constructed wetland would not be as effective during winter months.

Conventional Nitrification/Denitrification Treatment

Conventional suspended growth nitrification/denitrification treatment has been used to remove nitrogen from domestic wastewater at many wastewater treatment facilities throughout the United States. Such treatment has been shown to be effective on a variety of wastewater under a variety of climatic conditions. However, such treatment facilities are complex and may require multiple steps and high rate solids recycling and can be difficult to operate. The construction costs for a conventional suspended growth nitrification/denitrification facility are estimated to be 30 to 40 percent more than the proposed trickling filter - ABC nitrogen removal process. Operating costs are also greater for a conventional suspended growth nitrification/denitrification facility and are estimated at 80 to 100 percent more than the proposed trickling filter - ABC nitrogen removal process.

Socioeconomic Alternatives

Construction Employment Cap

The Agencies considered a construction employment cap to moderate the size of the anticipated employment and immigration fluctuations during mine development. This cap would have limited construction period employment to about the employment level expected during mine operations. The longer mine development period required under Alternatives IV and V resulted in lower construction employment peaks, similar to what an employment cap would have accomplished. Thus no formal employment cap was incorporated into an agency alternative.

Temporary Work Housing

To mitigate the expected shortage of short-term housing available to meet the needs of the contract construction workforce, Sterling would have been required to implement some mechanism for construction worker housing (such as company assistance in development of a work camp or mobile home court). This would alleviate the housing difficulties expected during the contract construction project phase and reduce the number of workers who would be forced to commute long distances to the work site.

Alternatives IV or V would utilize a maximum workforce during construction that would be about the same size as the expected operating force. The company has indicated an intention to work with local government to address the expected temporary housing shortage during the contract construction period. However, DEQ does not have the authority to require Sterling to provide temporary work housing.

PART IV: DESCRIPTION OF REASONABLY FORESEEABLE ACTIVITIES

This section discusses reasonably foreseeable activities proposed near the Rock Creek study area. Reasonably foreseeable activities are those that have been proposed in specific enough detail to allow evaluation at this time.

<u>Conservation Plan for Lynx</u>

On June 30, 1998, the U.S. Fish and Wildlife Service (USFWS) proposed that the lynx be listed as threatened according to the Endangered Species Act (ESA). If listed, the ESA requires that a conservation plan be drafted for this species. The primary responsibility for drafting such a plan lies with the USFWS, but input is sought from all affected agencies. A team (includes members from federal and state agencies across the western range of the lynx) has been established to provide this input. If appropriate, the USFWS would incorporate the input into their recovery plan. The recovery plan would include specific conservation measures that could affect all projects within the geographical range of this population.

<u>Conservation Plan for Bull Trout</u>

Effective June 10, 1998, the U.S. Fish and Wildlife Service (USFWS) determined that the Columbia River population of bull trout be listed as threatened according to the Endangered Species Act (ESA). Consequently, the ESA requires that a conservation plan be drafted for this species. The primary responsibility for drafting such a plan lies with USFWS, but input is sought from various federal and state agencies and tribal governments within the affected geographical region. The governors of both Idaho and Montana have created teams to draft recovery plans for bull trout. A draft recovery plan for Idaho's bull trout was published in January 1996 (Batt 1996). Montana's team, which includes members of federal and state agencies, the Confederated Salish-Kootenai Tribes, the American Fisheries Society, Plum Creek and the National Wildlife Federation, has drafted a recovery plan for 12 bull trout watersheds in Montana. These plans will be included by USFWS in its recovery plan. The recovery plan would include specific conservation measures that could affect all projects within the geographic range of this population segment.

Tri-State Implementation Council's Proposed Plans

A Tri-State Implementation Council has been established by the Clark Fork-Pend Oreille Basin Water Quality Steering Committee to implement management actions outlined in the management plan (U.S. EPA 1993). The council consists of representatives from federal, tribal, state, and county agencies along with citizens and special interest groups. Although the council has no regulatory or enforcement authority, it has important roles and responsibilities which include, but are not limited to the following: building strong citizen, community and agency support for the plan; coordinating the activities of the various agencies implementing the plan; developing timetables; identifying funding; establishing criteria for success; identifying or revising priority recommendations; communicating with appropriate groups as needed; providing a forum for public input and support; and overseeing ad hoc sub-committees to implement specific action items at the local community level.

Water quality "management objectives" contained in the plan that could have implications to the proposed Rock Creek Project include:

- Control nuisance algae in the Clark Fork River by reducing nutrient concentrations;
- Protect Lake Pend Oreille water quality by maintaining or reducing current rates of nutrient loading from the Clark Fork River; and
- Reduce near-shore eutrophication in Lake Pend Oreille by reducing nutrient loading from local sources.

Proposed initial management actions for the state of Montana to voluntarily implement these three objectives include the following items.

- Establish a basin-wide phosphate detergent ban;
- Establish numeric nutrient loading targets for the Clark Fork River and Lake Pend Oreille (the latter to be done by the state of Idaho) and implement a nutrient allocation strategy if voluntary nutrient control measures are unsuccessful in protecting water quality;
- Require nutrient monitoring as a condition of all wastewater discharge permits;
- Enforce an aggressive antidegradation policy with respect to nutrient sources;
- Develop and implement a nonpoint source management plan specifically for the Clark Fork Basin;
- Establish and maintain a water quality monitoring network to monitor effectiveness and trends and to better identify sources of pollutants; and

- Implement seasonal land application and/or other improvements at several municipal waste water facilities or industrial operations or modify nutrient limits for surface and subsurface discharges for some operations.

- If the state of Montana implements any of these action items, participation by waste water discharge permittees in affected stream segments may become mandatory if goals are not met voluntarily.

The Clark Fork River from its headwaters downstream to the Flathead River confluence is on Montana's list of water quality-limited waterbodies. Voluntary industry nutrient waste load allocation reductions are being encouraged[22] and supported by the state of Montana to restore water quality along this stretch of the Clark Fork River. If voluntary actions fail to achieve the needed improvements, the state will be required by EPA to use a formal, regulatory, permit-based approach to improve water quality in the Clark Fork River. The discharge point for the Rock Creek Mine would be located in a stretch of the River that is not on the state's water quality-limited list. However, nutrients in the mine's waste water discharge could negate some of the upstream nutrient control measures and also affect nutrient loading to Lake Pend Oreille.

Total Maximum Daily Load Allocation for Lake Pend Oreille and the Clark Fork River

The Clark Fork River in Idaho is listed as water quality limited due to metals pollution. Lake Pend Oreille is listed as water quality "threatened" due to increasing development and other concerns. Both waters are scheduled for development of a problem assessment and a total maximum daily load allocation (TMDL) to recover the impaired use, and to protect existing water quality. TMDLs are measured in loads (for example, lbs/day), not concentrations (for example, mg/L), to reveal the cumulative impacts to a discharge. On July 1, 1997, work was begun on developing a TMDL for Lake Pend Oreille and the Clark Fork River, with an anticipated completion date of Summer 2002. When the TMDLs become effective, Montana must meet these limits at the border. Idaho Technical Guidance proposes a total phosphorous target of 259,500 kilograms per year in the Clark Fork River at the Montana/Idaho state line, and a nitrogen to total phosphorus ratio greater than 15:1. However, the Montana and Idaho Border Nutrient Load Agreement has not yet been signed by all parties. This may or may not require a change to the applicant's discharge permit depending on the outcome of the problem assessments.

The Clark Fork River, from Warm Springs Creek to the confluence of the Flathead River, is listed as a high priority for TMDL development due to excessive nutrient loads and other sources of impairment. In addition, 97 miles of the Clark Fork below the confluence with the Flathead River to the Idaho border are listed as partially supporting aquatic life and cold-water fisheries due to flow alteration and thermal modifications resulting from dam operation and construction but is not listed as requiring a TMDL. Although no TMDLs for these waters are currently being developed by the State of Montana, the potential for the TMDLs exists.

[22] Voluntary measures include items such as upgrading the Missoula city water treatment plant to achieve a 90 percent reduction in phosphorus and nitrogen loading to the Clark Fork River.

Total Maximum Daily Load Allocation for Rock Creek

DEQ has listed Rock Creek (MT76N003-190) as an "impaired" stream on its list of Streams of Special Concern (303d list). Rock Creek had been listed as impaired for coldwater fisheries — trout and aquatic life support and threatened for metals due to resource extraction and for siltation of aquatic habitat due to silvaculture in the 1996 303d list. ASARCO petitioned to have Rock Creek delisted. DEQ determined that Rock Creek should not be listed as threatened for metals due to a change in definition of threatened. However, DEQ retained the impaired listing for Rock Creek as partially supporting aquatic life and cold water fisheries — trout due to fish habitat degradation and alternations caused by silvacultural practices in the 2000 303d list. In Judge Molloy's June 21, 2000, decision EPA, and therefore the department, cannot issue new or increased discharge permits for streams in the 1996 list until a TMDL has been developed. All TMDLs for the 1996 listed streams have to be developed by May 5, 2007. Rock Creek is scheduled for TMDL development in May 2007.

Relicensing of Noxon Rapids and Cabinet Gorge Hydroelectric Dams

WWP (now Avista Corporation) initiated relicensing activities in the fall of 1995 for its two hydroelectric facilities on the lower Clark Fork River - Noxon Rapids and Cabinet Gorge dams. The current license for these projects will expire in 2001. Avista filed an application with the Federal Energy Regulatory Commission (FERC) for a new license in February, 1999 (Avista 1999b).

Prior to filing of the application, Avista conducted a series of consultation meetings in Montana and Idaho with state and federal agencies, non-governmental organizations, affected Indian tribes, and local organizations, clubs, and the general public. This consultation effort resulted in a comprehensive relicensing agreement that was submitted to FERC as part of Avista's proposed relicensing alternative. The Clark Fork Settlement Agreement (Avista 1999c) became effective upon signing and implementation began in March 1999.

FERC issued its draft EIS for this relicensing in November 1999 (FERC 1999) and the final EIS (FERC 2000a) and order for a new license (FERC 2000b) in February 2000. The new license for the Clark Fork Project incorporates the Clark Fork Settlement Agreement subject to the limits of FERC jurisdiction, with additional measures to protect and enhance environmental resources. These additional measures include development and implementation of four plans to manage solid waste and wastewater, herbicides and pesticides, and other hazardous substances; and monitor streambank profiles in the lower Clark Fork River below the Cabinet Gorge Project.

The Clark Fork Settlement Agreement includes a comprehensive set of measures to protect, mitigate and enhance resources affected by operation of the Clark Fork Project. Implementation of these measures began in March 1999 and will continue over the 45-year term of the new license. These measures include the following activities, programs, and plans:

- Idaho tributary habitat acquisition and fishery enhancement;
- Montana tributary habitat acquisition and recreational fishery enhancement;
- Fish passage and native salmonid restoration;

- Bull trout protection and public education;
- Watershed councils program;
- Support of the water quality monitoring program of the Tri-State Implementation Council;
- Evaluation of mobilization of sediment trapped nutrients or heavy metals;
- Aquatic organism tissue analysis;
- Water quality protection and monitoring plan for maintenance, construction and emergency activities;
- Gas supersaturation control, mitigation and monitoring;
- Implementation of the land use, recreation resource, and aesthetics management plans;
- Implementation of the wildlife, botanical and wetlands management plan, including protection and enhancement of black cottonwood habitat, wetlands and forest habitat; protection of reservoir islands; and monitoring and protection of bald eagles, peregrine falcons, and common loons;
- Clark Fork delta habitat protection and mitigation;
- Clark Fork Heritage Resource Program;
- Erosion fund and shoreline stabilization guidelines; and
- Project operations package.

Measures proposed near the Rock Creek study area under programs for enhancement of Montana tributaries, restoration of native salmonids and fish passage, and formation of watershed councils may be cumulatively affected by or affect the Rock Creek Project. The program for enhancement of Montana tributaries and recreational fisheries will work to protect and enhance stream habitats that are important for long-term population viability of native salmonids. These efforts may also benefit recreational fisheries. Measures associated with restoration of native salmonids and fish passage also have the potential to be cumulatively affected by or affect the Rock Creek Project. For example, a study to be initiated in 2000 will strive to document the presence of migratory bull trout and determine the timing of juvenile out-migration in Rock Creek. Under the native salmonid restoration plan, passage for upstream migrating adult bull trout around Cabinet Gorge Dam is targeted for 2001. Under the watershed councils program, the Rock Creek Watershed Council was formed in 1999 to facilitate the protection and restoration of tributary stream habitat in this watershed. These and other measures implemented over the term of the new license could be affected by the Rock Creek Project or could complement mitigations included with one or more of the alternatives analyzed by the Agencies.

Timber Sales

The Cedar Gulch timber sale (1.6 MMBF) was sold in 1996 and is on NFS lands adjacent to the Rock Creek project area. Logging of the Cedar Gulch sale was completed in 1998. Any other sales that might be proposed will be subject to analysis under NEPA at the time of proposal. Sales may be modified or possibly dropped depending on the outcome of the assessment.

In March 1998, KNF signed the Forestwide Blowdown Salvage Decision Notice. Currently, there are no salvage timber sales identified in the Rock Creek drainage that would be implemented pursuant to this decision. Any future salvage sales would be implemented in accordance with this decision notice and would be required to meet all design criteria. Any sales would be subject to additional NEPA review including cumulative impacts analysis.

Logging on private lands has occurred over the past few years. Additional logging of private lands in the Rock Creek drainage can be expected to occur over the next 30 years. However, there is no information available to predict when and where it would occur.

Forestwide Herbicide Weed Control

The Kootenai National Forest prepared (in January 1997) and approved (on April 6, 1997) an Environmental Assessment to chemically control noxious weeds on roads, gravel pits, helispots, administrative sites, timberlands, rangelands and wildlands which are part of the National Forest System. Weed control could take place on up to 2,500 acres per year in the Kootenai National Forest, some of which could be within the Cabinet Ranger District depending on Forest priorities.

Montana Highway 200 Improvements

Montana Highway 200 is a paved, double-lane roadway that begins at the Montana-Idaho state line and travels across Montana to the North Dakota border. This highway is in varying stages of reconstruction. An overlay from milepost 22.6 to milepost 29.4 in the vicinity of Trout Creek was completed in 1999. Another overlay from milepost 46.2 to milepost 51.3 near Thompson Falls was completed in 2000. No further construction projects are planned for Highway 200 in the Rock Creek Project area. The junction of existing FDR No. 150 with Montana Highway 200 is about milepost 17.5 on the highway. A turn lane for Highway 200 would be added to the highway at the junction of FDR No. 150 to accommodate mine related traffic if the project is approved.

Noranda Minerals Corp.

The Agencies approved construction of the Montanore Project (as described in Alternatives 3C and 5 of that project's final EIS) in various decision documents (DSL, 11-92; KNF, 9-93; Department of Natural Resources and Conservation (DNRC), 11-92; DHES, 11-92; and COE, 10-93). Noranda's modified plans are for continued evaluation and development of the project in a phased approach. Only those aspects of the project that have relevance for cumulative impacts evaluation are discussed below.

The proposed project would consist of six primary components: an underground mine, a mill, three adits and portals, a tailings impoundment, access roads, and a 16.7-mile transmission line (See Figure 2-42). Access to the project is via U.S. Highway 2, Bear Creek Road (FDR No. 278), Libby Creek Road (FDR No. 231), and upper Libby Creek Road (FDR No. 2316). Although some of Noranda's ore body is less than 1 mile from Sterling's, the surface facilities would be almost 7 air miles apart. The Certificate of Environmental Compatibility and Public Need (under the Major Facility Siting Act) for the construction of the Montanore 230-kV transmission line was granted to the Noranda Minerals Corporation and Montana Reserves Company by the Board of Natural Resources and Conservation on June 3, 1993. This certificate expired on June 3, 1998 and Noranda or a new owner would need to apply for a new certificate for this or a similar facility.

Mine and Mill

Three adit openings would be excavated to access the ore body for mining; two adits from Ramsey Creek and one adit from Libby Creek. The Ramsey Creek adits would include a main conveyor adit and a parallel main ventilation intake adit. The Libby Creek evaluation adit (two-thirds complete and currently on hold) would serve as an exhaust ventilation adit. About 95 million tons of ore would be removed at a rate of 20,000 tons per day. The mill would be constructed on the north side of the creek across from the Ramsey Creek portals. Concentrates would be dewatered and shipped off site by truck.

Tailings Disposal

The Little Cherry Creek tailings impoundment area is located about 5 miles north of the Ramsey Creek mill complex. The impoundment area would consist of a diversion dam, diversion channel, tailings retention dam including a starter dam and toe dike, two earthfill dams, and seepage collection dam, encumbering about 994 acres. The tailings impoundment is designed to contain and permanently store about 120,000,000 tons of tailings. During operation, the tailings impoundment embankment would be constructed of cycloned tailings sands using the "downstream" method. The tailings impoundment would be built in stages over the 16-year operating period and ultimately would cover about 445 acres, with the final dam height at about 370 feet.

Support Facilities

A number of support facilities would be required for this project. These include buildings, conveyors, storage areas, roads, parking areas, utilities such as electric power and communication, pipelines such as water and tailings, and associated corridors.

Once an approved water treatment system is in place, Noranda is expected to operate on a 24-hour, 7-day per week, year-round basis completing its final evaluations of the ore body. This phase would employ about 60 people and take about 1 to 2 years.

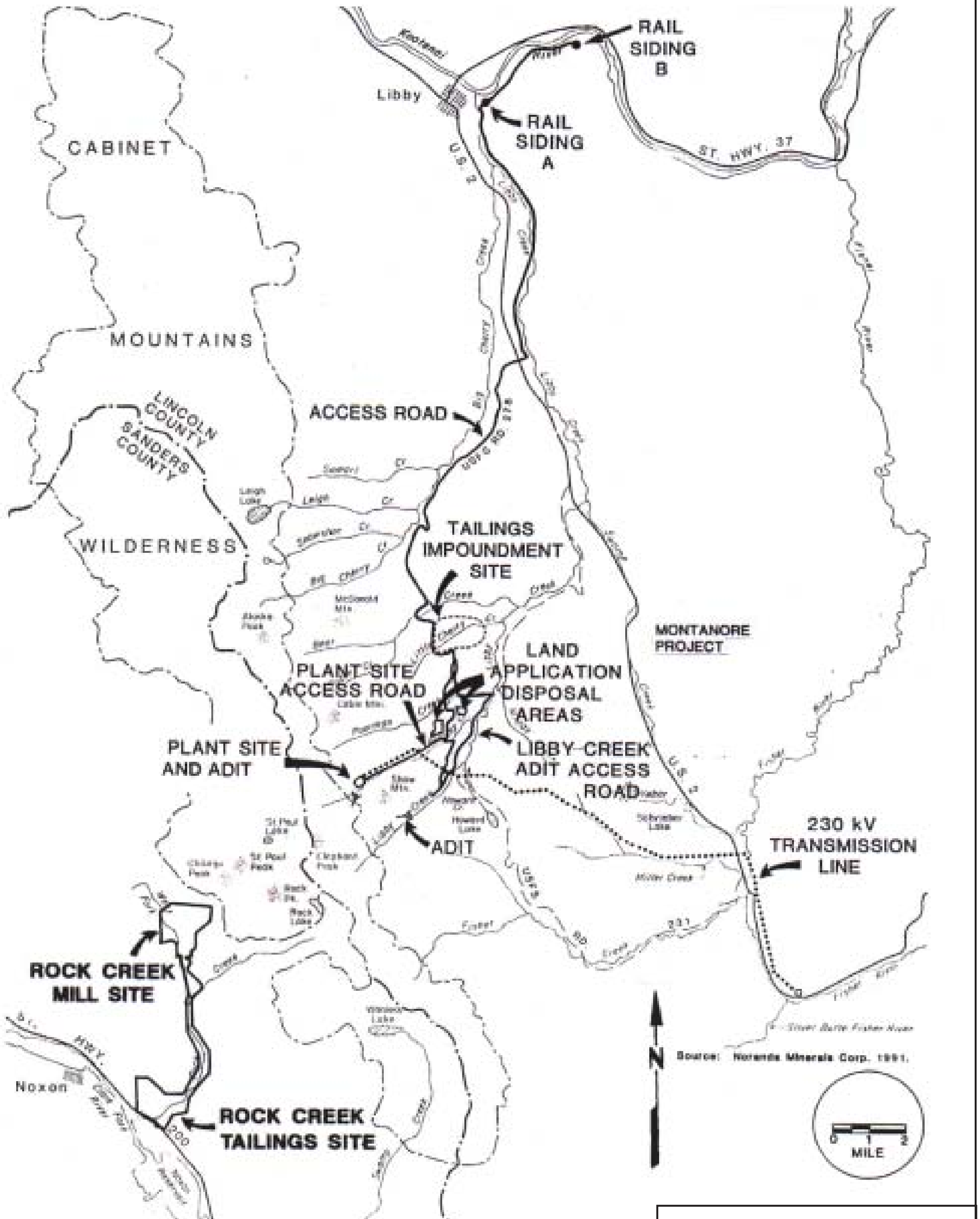


FIGURE 2-42
Montanore Project Proximity
Rock Creek Project

Personnel Requirements. Noranda would spend $200 to $250 million to develop the mine and anticipates an annual operating payroll of $12 million at full production. Construction would begin during the first quarter of year one with the hiring of about 30 employees and eventually would employ about 150. Construction would last about 2.5 years, peaking at 190 employees during the third quarter of year two. During year three, construction employment would be less than 100 employees. Total employment (construction and operations) is expected to peak at 530 employees during the third quarter of year three. Following completion of construction at the end of the third year of the project, total employment should level off at 450 workers and remain at this level through the life of the mine. These positions would be filled by hiring locally as much as possible. A training program would be established prior to and during operations.

The production schedule tentatively establishes three shifts per day, 7 days per week for 350 days per year. The estimated mine life is 16 years at full production. Postmining reclamation is estimated to last 2 years.

Private Land Access (opening closed roads)

The owners of record of three landlocked private properties[23] located in portions of Sections 28 and 33, Township 27 North, Range 31 West, and in portions of Section 12 and 13, Township 26 North, Range 31 West, and Section 30, Township 26 North, Range 30 West, have submitted special use permit applications for the construction of dry season roads to their property.

The Libby Ranger District on the Kootenai National Forest completed an Environmental Impact Statement (EIS) on February 4, 2000 which assessed and mitigated the environmental effects of the proposed road construction for the Wayup and 4th of July private properties. The proposed access roads are located approximately 30 miles south of Libby, Montana, along the east side of the Cabinet Mountains Wilderness. A biological assessment was completed on August 29, 1997 and followed up by a biological opinion (BO) from the USFWS on April 13, 1998 with an amendment on August 9, 1999. The terms and conditions from the BO were incorporated into the Record of Decision for this project. The Libby District is currently evaluating a proposal regarding private property near Bear Lakes, which may or may not require some form of access.

Resumption of Mining at Troy Mine

The Troy Mine is operated by Genesis, Inc. a wholly owned subsidiary of Sterling Mining Company. The mine is currently on care and maintenance due to low metal prices and project timing of the Rock Creek Project. Sterling has indicated an interest in restarting operations at the mine (Sterling Mining Co. 2000). The Troy Mine has approximately 7.0 million tons of mineable reserves that would be recovered over a 4 to 5 year period with a crew of approximately 170 workers. After completion of the mining sequence the mine area would be fully reclaimed. Depending on project timing, permitting and other financial considerations the workers from the Troy Mine would be phased into the Rock Creek Project.

[23] Wayup Mine, 4th of July Mine, and Bear Lakes mineral patents, respectively.

Prior to restart of the mine a Biological Assessment (BA) and consultation with the USFWS needs to be completed for bull trout. When the bull trout was listed, the mine was listed in a forest wide review of all projects at the time of listing as an action with a call of “Likely to Adversely Affect” if operating. Since the mine was in a care and maintenance mode at the time, no further action was taken. However, based on Sterling’s interest in restarting the mine, a BA is being prepared by the USFS and the Kootenai National Forest will initiate consultation with the USFWS once the BA is completed with a target date of June 2001 (USFS Kootenai National Forest 2001a).

Efforts are underway to develop a final reclamation plan for the site with emphasis on over water management issues. The revised reclamation plan and possibly an MPDES permit would most likely require environmental analysis under MEPA and NEPA because water quality impacts and potential long-term water treatment were not identified in the original 1979 EIS for the Troy Mine. This analysis could result in the agencies modifying the reclamation bond amount for the mine (MT DEQ 2001b).

PART V: COMPARISON OF ALTERNATIVES

The alternatives analyzed in this EIS were developed in response to the significant issues identified during scoping. The Agencies identified eight significant environmental issues to drive development of alternatives and evaluation of impacts. (See Issues and Development of Alternatives Process for more detail.)

The next two tables summarize the descriptions of the action alternatives. Table 2-21 provides a side-by-side comparison of mine development and operation features of each alternative. Table 2-22 compares the reclamation planning aspects of each alternative. These alternatives are described in detail earlier in this chapter. A detailed discussion of the alternatives' impacts is contained in Chapter 4. The following section summarizes the impacts, their magnitude, and level of significance, and discusses how impacts relate to the issues that drove alternative development.

Consequences of the Proposed Project and Alternatives

All alternatives would result in impacts of varying magnitude, duration, and importance to resources with regards to the eight issues discussed under Identification of Issues. However, as proposed, all action alternatives for the Rock Creek Project would result in potentially significant or significant impacts to environmental resources specified in seven of the issues. They are briefly summarized below. There were no significant or potentially significant impacts relative to Issue 7: Effects on Public Access and Traffic Safety.

TABLE 2-21
Rock Creek Project Alternative Comparison

Project Facility or Feature	Alternative II Proposed Rock Creek Project	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
Mill Site	6.5 miles up FDR No. 150 to upper end West Fork Rock Creek	Same as Alternative II	Confluence of east and west forks of Rock Creek	Same as Alternative IV
Tailings Impoundment	Rock Creek site 325 feet high, 324 acres, upstream construction	Same as Alternative II except modified centerline design w/technical review panel	Same as Alternative III	Same location as Alternative II but utilizing paste
Adit Waste Rock Dump	Southeast of adit 600,000 tons	Above mill site 600,000 tons, some used to create mill site	No separate waste rock dump. 1,000,000 tons used to create mill site and starter berms	Same as Alternative IV
Mine Adits, Length & Grade (to underground crusher)	Up Chicago Peak Rd (FDR No. 2741) 9,000' @+12.7%	Same as Alternative II	At confluence mill site 15,530' @+12%, portal east of FDR No. 150, mill west of FDR No. 150	Similar to Alternative IV, both mine portal and mill west of FDR No. 150.
Mine Adit Access	New gravel road from mill site	FDR No. 150 to FDR No. 2741 1.26 mi. to unnamed spur	FDR No. 150 to mill site. All within mill site boundary. FDR No, 150 underpass to access mine portal except for short spur off of FDR No. 150 for large equipment	FDR No. 150 to mill site. All access from within mill site boundary
Evaluation Adit Length & Grade	Portal near end of FDR No. 2741 6,592' @-10%	Same as Alternative II	Same as Alternative II	Same as Alternative II
Evaluation Adit Waste Rock	178,000 tons, Placed downhill of adit entrance	Same as Alternative II	Same as Alternative II	Same as Alternative II
Evaluation Adit Road, Length & Grade	FDR No. 150 to FDR No. 2741, upgrade FDR No. 2741 for 4.6 mi. & reconst 0.18 mi. spur to 14' wide, gravel	Same as Alternative II	Same as Alternative II plus improve 2.8 miles of FDR No. 150 above confluence mill site	Same as Alternative IV
Evaluation Adit Water Discharge Line	6" polyethylene line approx 8.5 mi. both X-C & along Rd 150, laid on surface for 3 yrs	Same as Alternative II	Same as Alternative II	Same as Alternative II
New Road Construction for Long-term Use	(1) 1.34 mi. new const beginning of FDR No. 150, 24' paved (2) Const 0.88 mi. of 14' graveled road around mill (3) N/A (4) Const 2.33 mi. of 14' graveled road from Sec. 15 to impoundment and const 1.02 of 10' graveled road in Sec. 3 & 10, both along slurry/reclaim lines	(1) 2.16 mi. new const beginning of FDR No. 150, 24' paved (different location than Alternative II) (2) Same as Alternative II except 24' wide (3) Const 0.23 mi. to connect FDR No. 150 to FDR No. 1022, gravel, 14' wide (4) Const 0.61 mi. of 14' gravel road along slurry line, Sec 3 & 10	(1) Same as Alternative III (2) Const 0.04 mi. of 24' paved road into mill site (3) Same as Alternative III (4) N/A	(1) Similar to Alternative III along different alignment for 1.62 miles (2) Same as Alternative IV (3) Same as Alternative III (4) N/A

TABLE 2-21
Rock Creek Project Alternative Comparison (Cont'd)

Project Facility or Feature	Alternative II Proposed Rock Creek Project	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
New Road Construction for Long-term Use (Continued)	(5) N/A	(5) 0.08 mi. of 10' road for slurry/reclaim line (Rd150-B to water reclaim pump), gravel	(5) Same as Alternative III	(5) Same as Alternative III
	(6) Const 1.43 mi. of 14' road around S & W of tailings imp for access to dam base and seepage collection line	(6) Const 1.6 mi. of 14' road around S end of tailings imp for access to dam base & rail loadout (paved w/turnouts)	(6) Same as Alternative III	(6) Same as Alternative III
	(7) N/A	(7) Const 0.25 mi.of 14' road to access rail loadout (paved)	(7) Same as Alternative III	(7) Same as Alternative IV
	(8) N/A	(8) Const 0.57 mi.of 10' road - gravel for seepage collection line	(8) N/A	(8) Same as Alternative III plus const. 0.22 mi. - 14' of paved road to paste plant
	(9) Mine Adit Access 1.41 mi. @ 6.5%, 20' wide with 75' ROW, graveled	(9) N/A - see Road Reconstruction	(9) N/A	(9) N/A
	TOTALS: 1.34 mi. paved and 7.07 mi. gravel roads	**TOTALS: 4.01 mi. new paved and 2.29 mi. new gravel roads**	**TOTALS: 4.19 miles paved and 0.25 gravel roads**	**TOTALS: 3.73 miles paved and 0.88 gravel roads**
Road Reconstruction for Long-term Use	(1) FDR No. 150 to mill, widened to 24' & paved for 5.1 mi.	(1) Same as Alternative II, but 4.02 mi., paved	(1) Same as Alternative II except only to confluence mill site, 2.94 mi., paved	(1) Same as Alternative IV but 3.42 mi.
	(2) FDR No. 150B from FDR No. 150 to seepage collection system 0.96 mi. of 14' (gravel)	(2) Improve FDR No. 150-B for 1.7 mi. from Rock Creek crossing to tailings impoundment, widen to 14' slurry line on inside edge of road (paved w/turnouts)	(2) Same as Alternative III	(2) Same as Alternative III including paste plant access 0.76 mi. paved and 1.07 mi. graveled
	(3) Discharge line road to river 0.75 mi. - 10' wide	(3) Same as Alternative II but graveled	(3) Same as Alternative III	(3) Same as Alternative III
	(4) N/A	(4) Reconst. 0.19 mi. of FDR No. 150 from north end of mill site to FDR No. 1741 to 20' wide graveled	(4) Reconst. 0.24 mi. of FDR No. 150 between mill entrance road and portal spur road to 24' wide, graveled	(4) N/A
	TOTALS: 5.1 mi. paved, 0.96 graveled, 0.75 dirt	**TOTALS: 5.72 mi. paved, 2.6 mi. graveled**	**TOTALS: 4.64 mi. paved, 0.99 graveled**	**TOTALS: 4.18 mi. paved, 1.82 graveled**
Slurry and Reclaim Lines	From mill along FDR No. 150 to approx. center Sec. 3, then X-C to impoundment 4.7 mi. (two 10" high pressure urethane-lined steel slurry lines on piers, 1 buried 12' steel reclaim line) 3.3 mi. would be X-C, 1.4 mi. along FDR No. 150	Same as Alternative II to SE of Sec. 15 then continues on FDR No. 150 to SE of Sec. 22 where it follows FDR No. 150-B to impoundment 0.3 mi. X-C in Sec. 10 & 4.9 mi. parallels FDR No. 150	From mill along FDR No. 150 to intersection of old and new FDR No. 150, parallels FDR No.150B to tailings impoundment 3.8 mi.	Same route as Alternative IV but 4 mi. One 16-24" urethaned-lined steel pipeline for slurry, 16" reclaim water pipeline.

TABLE 2-21
Rock Creek Project Alternative Comparison (Cont'd)

Project Facility or Feature	Alternative II Proposed Rock Creek Project	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
Excess Mine Adit Water Handling	(1) 12" polyethylene line buried adjacent to road from adit to mill, 6,700' (2) From mill 12" buried line parallels slurry line to Sec. 15, then parallel's FDR No. 150 to MT Hwy 200, then would parallel hwy for 500', would cross and parallel road to Clark Fork for 6.1 mi.	(1) Buried from adit down ridge 3,000' to mill (2) 12" steel excess water line parallels slurry line to intersection of new FDR No. 150, then parallels FDR No. 150 to waste water treatment plant, remainder same as Alternative II, 7.5 mi.	(1) N/A (2) Follows basically the same route as Alternative III except starts at confluence mill site, 6.1 mi.	(1) N/A (2) Basically the same as Alternative IV except 12-14" and goes X-C in Section 33 5.7 mi.
Transmission Line 230 kV Pole Line	Parallels existing 230 kV line from switchyard. Would cross hwy, then parallel newly constructed & reconstructed FDR No. 150 to mill, 5.7 mi.	Starts as in Alternative II, then parallels proposed FDR No. 150 & reconstructed FDR No. 150 to mill 6.6 mi. total length	Same as Alternative III except only goes to confluence mill site 5.2 mi.	Same as Alternative III except near waste water treatment site 5.3 mi.
Conveyor Line	From adit to mill 2,500' by 42" wide	Same as Alternative II	750' long within mill site	Same as Alternative IV
Wilderness Air Intake Ventilation adit	On approx 57% slope, 1,600' NE of ridge @ elev of 5,760'	In the cliffs on approx. 150% slope, 400' NE of ridge @ elev of 6,700'	Same as Alternative III	Same as Alternative III
Rail Loadout Location	At Herford siding	Miller Gulch	Same as Alternative III	Same as Alternative III
Tailings Impoundment Starter Dam Borrow	735,000 cu. yards of borrow from within impoundment & 3 borrow sites (27.2 acres)	Same as Alternative II	735,000 cu. yards of borrow from within impoundment, waste rock from adit construction and borrow site 3 (27.2 acres)	Borrow from within impoundment and utilize waste rock from adit construction
Ore Concentrate Transport Method	Ore concentrate trucked to Herford Siding	Ore concentrate trucked to Miller Gulch rail loadout	Same as Alternative III	Ore concentrate slurried in buried pipeline to Miller Gulch rail loadout via 3" dual wall pipe with leak detection
Soil Storage (1) Evaluation Adit (2) Support Facilities (3) Tailings Impoundment and associated components	(1) North end; 1.2 ac; 8,757 cy (2) Adjacent storage; 1.3 ac; 4,193 cy (3) Impoundment, borrow areas, pump station S-1 parallel to powerline; 11.3 ac; 248,086 cy S-2 northeast corner near borrow site B-2; 8.3 ac; 179,649 cy Roads (access, haul); adjacent storage; 5.4 ac; 9,290 cy Water control structures; adjacent storage; 9.2 ac; 17,141 cy	(1) Same as Alternative II (2) Same as Alternative II (3) Similar to Alternative II but stockpiles S-1 and S-2 expanded to handle additional volume: S-1 increases to 19 ac; 563,227 cy S-2 increases to 17.7 ac; 549,598 cy Roads 9,290 cy Water control structures 17,141 cy	(1) Same as Alternative II (2) Same as Alternative II (3) Same as Alternative III	(1) Same as Alternative II (2) Same as Alternative II (3) Same as Alternative III but soil stockpiles reduced to 18 ac. because soil would be salvaged incrementally and replaced concurrently, other sites available if needed.

TABLE 2-21
Rock Creek Project Alternative Comparison (Cont'd)

Project Facility or Feature	Alternative II Proposed Rock Creek Project	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
(4) Transportation Corridor	(4) Stored adjacent to each component; total 29.3 ac; 56,371 cy	(4) Soil stored adjacent to each component only when salvage showed clear benefit to revegetation and would not result in excessive disturbance	(4) Same as Alternative III	(4) Same as Alternative III
(5) Water Treatment Facility	(5) Adjacent storage; 10.0 ac; 32,269 cy	(5) Same as Alternative II	(5) Same as Alternative II	(5) Same as Alternative III
(6) Mill Facilities	(6) S-3 south end; 2.5 ac; 42,271 cy S-4 north end; 3.4 ac; 56,910 cy adjacent storage 1,010 cy	(6) Similar to Alternative II but stockpiles S-3 and S-4 expanded to handle additional volume: S-3 increases to 78,921 cy S-4 increases to 93,560 cy	(6) New location at confluences mill site: north-center; 4.1 ac; 151,665 cy	(6) Same as Alternative IV
(7) Mine	(7) Top soil storage; S-5, 1.5 acres	(7) Similar to Alternative II but soil stored along toe/sides of 2 small waste rock dumps; 9,681 cy	(7) Included in mill facilities (6) above	(7) Same as Alternative IV
	Total cubic yards: 655,949	**Total cubic yards: 1,423,010**	**Total cubic yards: 1,392,513**	**Total cubic yards: 1,392,573**
Mine Adit Water Treatment	Clarification filtration with a passive biotreatment and ion exchange system	Same as Alternative II	Same as Alternative II	Clarification, filtration, nitrification, denitrification (anoxic biotreatment and/or reverse osmosis), aerated pond with settling system.
Evaluation Adit Water Treatment	Pressure filtration, oil skimmer, and a passive biotreatment and ion exchange system	Same as Alternative II	Same as Alternative II	Pressure filtration, oil skimmer, and a reverse osmosis with a pilot anoxic biotreatment system.

Notes: X-C means cross country; N/A means not applicable; ROW means right-of-way; cy means cubic yards.

TABLE 2-22
Rock Creek Project Reclamation Comparison

Reclamation Feature or Component	Alternative I No Action	Alternative II Proposed Rock Creek Project	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
TAILINGS STORAGE AND ASSOCIATED FACILITIES					
Soil depth (average)	18-33 inches (30 inches average)	Salvage depth - 11.0 inches Respread depth- 9.5 inches on impoundment - 11.4 inches on facilities - 14.3 inches on transportation corridor	Salvage Depth: 24 inches in two lifts Respread depth - 24 inches on tailings	Same as Alternative III	Same as Alternatives III and IV.
Interim[1] revegetation on dam faces	N/A	None	Interim revegetation with G/F[2] until reshaping completed	Same as Alternative III	Interim mix (where necessary) would be the same as the final mix. Interim seed mix would be added to paste to limit erosion off paste slopes during operations and to reduce aesthetic impacts.
Final revegetation on dam faces	N/A	Phased during construction with seeded G/F/S[2] Containerized S/T[2] during post mine operation reclamation	Initiated after 7th year of construction. Phased in during remaining years of mine operation with seeded G/F and containerized S/T[2] every 3-4 years	Same as Alternative III Same as Alternative III	Toe buttresses and paste deposit slopes would be seeded with final revegetation mix on any portion that reaches final grade annually regardless of option.
Planting plan	N/A	Alternating strips for drill-seeded species (8-feet wide) and containerized species (2- to 4-feet wide), 6-foot spacing for trees	Plans replicate naturally occurring species, densities, and distributions	Same as Alternative III	Same as Alternatives III and IV.
Postmining topography	N/A	Smooth planar faces and abrupt transitions to adjacent topography	Reshaping and grading of faces (years 7 to end of mine life) every 3-4 years Smooth transitions from human made to natural land forms	Same as Alternative III	Portions of the paste facility and toe buttresses that reach final grade would be reclaimed annually. Smooth transitions from human made to natural landforms.

TABLE 2-22
Rock Creek Project Reclamation Comparison (Cont'd)

Reclamation Feature or Component	Alternative I No Action	Alternative II Proposed Rock Creek Project	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
Associated facilities: soil stockpiles, roads, pipeline corridors	N/A	Interim reveg with G[2]	Same as Alternative II	Same as Alternative II	N/A
	N/A	Final reveg with seeded G/F/S[2] and containerized T[2] on stockpile sites and roads. No T on transportation corridor, only S.	Final reveg with containerized S/T on stockpile sites as depleted; road cut fill slopes and pipeline corridors immediately	Same as Alternative III	Final revegetation on all operational disturbances as completed. Interim mix (where necessary) would be the same as the final mix.
MILL SITE, PORTAL, AND ASSOCIATED FACILITIES					
Soil depth (average)	21 inches	Salvage depth - 21 inches Respread depth -11.4 inches	Salvage depths: Lift 1 - 11 inches Lift 2 - up to 25 inches Respread depth - 24 inches (in 2 lifts)	Salvage depth: Lift 1 - 19 inches Lift 2 - 6 inches Respread depth - 24 inches in 2 lifts	Same as Alternative IV.
Final reclamation	N/A	Revegetation with seeded G/F/S[2] and containerized T[2] at end of mine life	Revegetation with seeded G/F and containerized S/T[2] at end of mine life	Revegetation with seeded G/F and containerized S/T after year 4 on pad faces Revegetation on pad surface at end of mine life	Same as Alternative IV.
Planting plans	N/A	Alternating strips for drill-seeded species (8-feet wide) and containerized species (2- to 4-feet wide), 6-foot spacing for trees	Plans replicate naturally occurring species, densities, and distributions	Same as Alternative III	Same as Alternative III.
Postmining topography	N/A	Abrupt transition to adjacent topography at mill site and portal	Reshaping and grading of mill site and portal area (at end of mine life) to more natural appearing forms Smooth transitions from human made to natural land forms	Same as Alternative III for portal. Shaping of mill pad faces in years 1-4 Reshaping of pad surface at end of mine life	Same as Alternative IV.
MINE WASTE ROCK DUMP					
Soil depth (average)	0-24 inches	Salvage depth up to 24 inches on part of waste rock dump Respread depth - 11.4 inches (soil from mill site area used on part of upper slope and top)	Salvage depth: Lift 1 - 24 inches on ≤ 40% slopes. Respread depth: 0-24 inches with two smaller dumps (additional soil from mill site as needed)	N/A - no separate waste rock dump	N/A - no separate waste rock dump
Final reclamation	N/A	Revegetation with seeded G/F/S[2] and containerized T[2] at end of mine life	Revegetation with containerized S/T[2] in year 5	N/A	N/A

TABLE 2-22
Rock Creek Project Reclamation Comparison (Cont'd)

Reclamation Feature or Component	Alternative I No Action	Alternative II Proposed Rock Creek Project	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
Planting Plans	N/A	Reforestation on top.	Same as Alternative II	N/A	N/A
Postmining topography	N/A	Top 1-2 % slope Face 1.25:1 slope	Same as Alternative II	N/A	N/A
EVALUATION ADIT AND WASTE ROCK DUMP					
Soil depth (average)	Average 9.2 inches over 7.7 acres	Salvage depth: From 4.3 acres: Lift 1 - 6 inches (2.0 acres) and 5 inches (2.3 acres) Lift 2 - 24 inches (2.0 acres)	Salvage depths same as Alternative II	Same as Alternative III	Same as Alternative III.
Final Reclamation		Respread depth (1.9 acres on dump face 13 inches) (5.0 acres on adit, dump and facilities 12 inches) (1.4 acres of face left as talus). Final revegetation in year 3 on waste rock dump	Respread depth similar to Alternative II but areas respread would coincide with planting plans	Same as Alternative II	Same as Alternative III.
Revegetation	N/A	Seeded immediately after construction with G/F[3] on access road, soil stockpiles, and surface water control features Adit and grass seeding as features are recontoured (as soon as possible after completion of evaluation work)	Interim seeding with G/F[2] on access road, ditches, and soil stock piles Final seeding of disturbed areas with containerized S/T[2], except evaluation adit.	Same as Alternative III	Same as Alternative III.
Planting plans	N/A	Uniform G[2] cover on 4.9 acres with 1.4 acres left as talus. No reforestation	Pockets and edges of disturbed areas planted with S/T[2] to achieve mosaic appearance similar to adjacent slopes	Same as Alternative III	Same as Alternative III.
Postmining topography	N/A	Top of dump 1-2% slope. Face of dump graded to 2H:IV slope; bench approximately 100-feet wide retained.	Dump recontoured to approximate existing contours with no bench.	Same as Alternative III	Same as Alternative III

TABLE 2-22
Rock Creek Project Reclamation Comparison (Cont'd)

Reclamation Feature or Component	Alternative I No Action	Alternative II Proposed Rock Creek Project	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations	Alternative V Paste Facility & Alternative Water Treatment
EVALUATION ADIT SUPPORT FACILITIES SITE					
Soil Depth	24 inches 30 inches average for alternate location	Salvage depth (24 inches)	Same as Alternative II	Same as Alternative II	Salvage 24 inches in 2 lifts (adjacent to paste facility site)
Final Reclamation		Respread depth (24 inches)	Same as Alternative II	Same as Alternative II	Respread depth - 24 inches in two lifts
Revegetation	N/A	Same as for impoundment			Same as paste facility
Planting plans	N/A	Same as for impoundment			Same as paste facility
Postmining topography	N/A	Support facility site returned to approximate original contour	Support facility site same as Alternative II.		Alternate support facilities site reclaimed to approximate original contour.
WATER TREATMENT FACILITY					
Soil Depth (ave)	24 inches	Salvage depth 24 inches Respread depth 24 inches	Different location but otherwise same as Alternative II	Same as Alternative III	Same as Alternative III
Revegetation	N/A	Interim revegetation during operation. Final revegetation after treatment plant decomissioned	Same as Alternative II	Same as Alternative III	Same as Alternative III
Planting Plans	N/A	Same as for tailings storage facility	Same as Alternative II	Same as Alternative III	Same as Alternative III
Post-mining Topography	N/A	Return to approximate original contour	Same as Alternative II but different location	Same as Alternative III	Same as Alternative III

Notes:
[1]Interim - a temporary grass seed mix used primarily for soil stabilization that would be replanted with a final seed and/or planting mix.
[2] G/F/S/T - Grasses/Forbs/Shrubs/Trees specified for revegetation; see Appendix G for seeding and planting proposals.
[3] Same G/F seed mix proposed for interim and final revegetation on evaluation adit.
N/A = not applicable

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

In Montana, effects are predicted to impact

- the distribution of surface water and ground water resources (all action alternatives);
- aquatic invertebrates from sediment (Alternatives II and III) and nutrient loads (Alternatives II, III, and IV);
- surface water quality from spills and pipeline ruptures (all action alternatives);
- ground water quality from tailings facility seepage (all action alternatives); and
- wilderness lake water balance and chemistry and aquatic life from lowered ground water levels (Alternatives II-IV) and the remote possibility of subsidence (all action alternatives); and
- ground water and surface water quality near the orebody due to seepage from the underground mine reservoir (Alternatives II-IV).

No measurable increases to the concentrations of constituents in surface or ground water resources in Idaho are predicted.

Issue 2: Effects on fish and wildlife and their habitats and current and proposed threatened and endangered species.

Effects are predicted to impact

- grizzly bear habitat due to lost and reduced effective habitat and increased mortality (all action alternatives);
- neotropical migrant birds and pileated woodpeckers due to direct and indirect loss of old growth habitat (Alternatives II - IV);
- harlequin ducks due to disturbance, habitat alteration, and increased mortality risk (Alternatives II - IV);
- bull trout due to increased sediment (Alternatives II and III); and
- westslope cutthroat trout due to increased interbreeding with non-native species (Alternatives II, III, and IV).

Issue 3: Stability of the tailings impoundment/paste facility.

Effects from impoundment/paste facility failure are predicted to impact

- surface water quality and aquatic life in lower Rock Creek, the Clark Fork River, Cabinet Gorge Reservoir, Miller Gulch, and to a lesser extent Lake Pend Oreille if failure occurred (all action alternatives).

Issue 4: Impacts to socioeconomics of surrounding communities.

Effects are predicted to

- alter immigration patterns in local area communities (all action alternatives);
- increase the demand for and price of housing in communities near the site (all action alternatives);
- alter existing employment and income patterns and trends in local area communities (all action alternatives); and
- cause increased and fluctuating demand for most public sector services (including schools and water and waste water treatment systems) (all action alternatives).

Issue 5: Effects on old growth ecosystems.

Effects are predicted to

- Directly impact 0 to 28 acres of old growth (all action alternatives).
- Change habitat effectiveness from the existing condition. Effectiveness would be reduced by 19 to 94 acres (Alternatives II through IV), or increased by 1 acre (Alternative V).

Issue 6: Effects on Wetlands and Non-wetland Waters of the U.S.

Effects are predicted to impact

- The functions and values up to 9.6 acres of wetlands and non-wetland waters of the U.S. would decrease until mitigation sites were established (all action alternatives). Between 10 and 13.8 acres (depending on the alternative) have been proposed for wetland mitigation (approximately 1.5:1 ratio).

Issue 8: Effects on aesthetic quality, including noise, visual, and wilderness experiences.

Effects are predicted to impact

- residents at Hereford (Alternative II only) and travelers on FDR No. 150 due to increases in sound levels from mine activities and traffic respectively (all action alternatives);

- visual quality of Rock Creek and Clark Fork Valley and ability to comply with Forest Service VMS standards due to size, shape, color, texture and contrast of mine facilities with surrounding landscapes and the amount of time needed for reclamation/revegetation to mitigate impacts (all action alternatives); and

- wilderness values near the air intake ventilation adit due to visibility and noise levels (Alternative II and to a lesser degree under all other action alternatives).

Table 2-23 and the following descriptions provide a more detailed summary comparison of the effects of all alternatives with regards to all eight significant issues identified earlier in this chapter. See Chapter 4 for more detail on the environmental consequences of implementing any of the five alternatives.

Changes in Water Resources

Surface and Ground Water Quality. The Agencies' analyses are based on assumptions that may vary from actual mining, climate, and site conditions during operation and reclamation and cannot be known completely in advance. There are variables that could affect the levels of impacts to surface and ground water quality for nutrients, certain metals, and sediment. These include actual concentrations of nitrogen in the blasting media used, the number of explosive misfires or incomplete reactions, actual waste rock and ore geochemistry, particle size of waste rock and tailings, actual infiltration capacity of the mill and tailings facility sites, rainfall and temperature conditions, actual streamflow, and efficiency of the proposed water treatment facility. These variables are discussed in detail in Chapter 4. The agencies' assumptions are reasonable, conservative (increased safety factor), and protective of water quality.

Alternatives II through V would result in some short-term and possibly long-term changes in existing surface water quality that would comply with Montana and Idaho non-degradation water quality standards. The concentrations would be unmeasurable after dilution with Clark Fork River. This would be due in part to the proposed filtration and treatment of discharged water; concentrations of sediment and nutrients would be reduced. It is also due to the dilution afforded by the relatively higher flow of the Clark Fork River.

Waste water treatment would be required as long as water being discharged into the Clark Fork River from the impoundment/paste facility, adits, and underground mine did not meet MPDES effluent limits.

The adits could be plugged at their upper end, allowing water entering the adits to drain but holding back water entering the mined out area. If the mine adits were not sealed at their lower ends, which could occur under Alternative II, mine adit water would not be allowed to discharge into Rock Creek as it is unlikely that the adit waters could meet water quality standards relative to Rock Creek. Adit water would have to be perpetually piped, treated if necessary, and discharged to the Clark Fork River. If the adits were sealed after mine closure, as required for Alternatives II - IV, mine water could eventually discharge into bedrock, and possibly out through springs. The most likely locations for these springs are below the outcrop zones at the north and south portions of the ore body and possible in Copper Gulch (MT DEQ 2001a). Water draining from the adits would drain into the mine waste rock fill at the mill site and into the alluvium beneath it and then possibly into Rock Creek.

TABLE 2-23
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Water Resources					
Surface water quality	Except for minor increases in sediment, existing surface water quality would be maintained.	Minor increases in metals, nitrogen, ammonia, and total dissolved solids concentrations in Clark Fork River from treated discharges during operations. Must comply with MPDES permit and Montana Water Quality Standards	Same as Alternative II	Same as Alternative II	Similar to Alternative II but with increased water treatment reliability and minor increases in phosphorus due to changes in waste water treatment systems.
	N/A	**Nitrogen loads would be temporarily increased in Rock Creek and the west fork during mine construction and would impact aquatic invertebrates and algae in the short term.**	**Same as Alternative II**	Similar to Alternative II but impacts to the aquatic life in the West Fork of Rock Creek above the confluence mill site would be much reduced. The 300' buffer zone around confluence mill site would reduce nitrogen loading to Rock Creek from the waste rock used in mill pad construction.	Same as Alternative IV.
	Sediment-loading for Rock Creek may temporarily increase due to construction of roads and land clearing for timber sales.	Sedimentation may be reduced because timber road construction for NFS lands in the Rock Creek drainage may be limited due to project increased open road densities.	Same as Alternative II plus sediment would also be reduced by relocating a portion of FDR No. 150 and the utility corridor and by identifying and reducing existing sediment sources.	Same as Alternative III.	Same as Alternative III plus additional sediment reduction due to fewer roads, paste facility construction, modified reclamation plans, reduction in mine-related traffic, and sediment mitigation on two or more sediment sources in Rock Creek.
		Impacts from materials from spills and pipeline ruptures potentially could affect water quality in Rock Creek and the Clark Fork River.	**Same as Alternative II except the potential for material from spills and pipeline ruptures to reach the main stem of Rock Creek is reduced.**	**Same as Alternative III except potential for spills and pipeline ruptures in the West Fork of Rock Creek would be eliminated due to mill site relocation.**	Potential for pipeline ruptures would be reduced because tailing, process water, and ore concentrate pipelines would be double-walled with leak detection. Impacts from spills of ore concentrate would be minimized by piping to an enclosed rail loadout facility and all pipelines would be buried except at bridge crossings.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Ground water quality	Ground water quality would be similar to existing quality.	Ground water quality standards for nitrates and dissolved manganese would be exceeded within an approved mixing zone during construction and operation of tailings impoundment. Downgradient ground water quality would not be affected beyond the mixing zone as a result of a ground water extraction and pump-back system. Ground water quality near the ore body may decrease due to seepage from the underground mine reservoir.	Similar to Alternative II, except impoundment seepage would be reduced by using excavated clays to seal permeable contact zones. The technical panel reviewers for impoundment design would investigate the use of seepage reduction techniques (which may include synthetic or clay liners) to further minimize seepage if acid-base accounting of tailings indicated potential for acid drainage.	Same as Alternative III.	Similar to Alternative III; however, tailings seepage would be reduced by one order of magnitude to approximately 20 to 30 gpm due to paste technology.
Surface water quantity	Appropriated water would continue to be withdrawn from surface water.	Surface flow in Miller Gulch would be reduced during operations. Slight potential for ground water withdrawal to reduce surface flows of springs.	Same as Alternative II.	Same as Alternative II.	Similar to Alternative II.
Ground water quantity	Ground water well production from appropriated sources would be similar to existing production.	Possible decrease in static water levels in wells not in Clark Fork alluvium and spring flow downgradient of Miller Gulch during operation.	Same as Alternative II.	Same as Alternative II.	Same as Alternative II.
		Portal plugging and subsequent mine flooding may generate downgradient springs	Same as Alternative II.	Same as Alternative II.	1,000-foot buffer zone along ore outcrop zones plus a 450-foot vertical buffer between the mine workings and the surface should minimize the potential for the creation of post-mining springs and seeps. Adit closure plans would be finalized depending on impacts that occurred.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Springs and Seeps and Wilderness lakes	Springs and seeps and wilderness lakes would continue to experience natural and seasonal water level fluctuations.	**The potential for subsidence is remote. Impacts would be potentially significant. Lakes could potentially be drained if subsidence reached the surface. Ground water drainage stresses would affect ground water recharge and water chemistry of wilderness lakes and springs.**	**The potential for subsidence and ground water drainage stresses to wilderness lakes and springs, although remote, would be further quantified by additional rock mechanics studies and a subsidence control plan. Impacts would be potentially significant.**	**Same as Alternative III.**	**Similar to Alternative III, but 1,000-foot buffer zones around Cliff Lake and the north and south ore outcrop zones would minimize the risk of affecting water levels and water chemistry to the lakes and springs. Possibility of occurrence would be remote.**
Wildlife, Habitat, and Threatened & Endangered (T&E) Species					
Grizzly bears	Continued availability of spring and fall grizzly bear habitat.	**Direct physical loss of 584 acres of habitat. Habitat effectiveness would be reduced on an estimated 7,308 acres during operation. This would have a potentially significant impact on grizzly bear habitat. Decrease in habitat effectiveness in all impacted BMUs.**	**Direct physical loss of 609 acres of habitat. Habitat effectiveness would be reduced on an estimated 7,001 acres during operation. This would have a potentially significant impact on grizzly bear habitat.**	**Direct physical loss of 542 acres of habitat. Habitat effectiveness would be reduced on an estimated 6,635 acres during operation. This would have a potentially significant impact on grizzly bear habitat.**	**Direct physical loss of 482 acres of habitat. Habitat effectiveness would be reduced on 6,428 acres during operation. This would have a potentially significant impact on grizzly bear habitat. Mitigations from the BO would reduce this impact and preclude jeopardy**
	Slight increase in habitat effectiveness due to road closures.	The KNF determined there would be a need to close 5.28 miles of roads (see Transportation) to meet the open road density standards for grizzly bear habitat.	Open and total road densities would be reduced by closing 4.18 miles of road in order to maintain and improve grizzly bear habitat effectiveness.	Same as Alternative III.	Open and total road densities would be reduced by closing 5.22 miles of road in order to maintain and improve grizzly bear habitat effectiveness.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Grizzly bears (Continued)		Potential increased mortality from road kills, poaching, and destruction of nuisance bears.	Similar impacts as Alternative II but somewhat reduced due to additional mitigations.	Same as Alternative III.	Similar to Alternative III, but potential decreased even more due to required training of workers about working and living in grizzly bear habitat, and implementing of a food storage order for the BMUs affected by the project.
Bull trout	Private and KNF timber sales and other developments within the Lower Clark Fork River watershed should maintain the functioning of habitat for bull trout.	**Increased sediment in the west fork and mainstem of Rock Creek would significantly decrease emergence success of bull and cutthroat trout fry.**	**Modifications and mitigations would reduce the amount of sediment impacting Rock Creek spawning habitat for bull trout in Rock Creek.**	**Sediment impacts to bull trout would be minimized in the West Fork of Rock Creek. The 300 ft. buffer around the confluence mill site would reduce impacts from sediment loading downstream.**	**The lesser amount of disturbed acreage, relocation of evaluation support facility, and sediment mitigations prior to construction should further reduce sediment impacts in the short term. Additional sediment mitigation and negotiation with land owners to reduce sediment sources may improve habitat in the long term.**
	Natural changes in aquatic habitat are expected, marginal threat to long-term survival for Cabinet Gorge bull trout stock.	**Potential increase in non-native fish species abundance and interbreeding with bull trout.**	Risk of interbreeding and non-native fish species increase would be reduced due to sediment mitigations.	Similar to Alternative III.	Additional sediment mitigation would further reduce risk of interbreeding and non-native fish species increases. Study of bull trout migration past the diffuser could result in diffuser design modification to ensure passage past the diffuser to Noxon Dam and allow capture of fish and movement upstream beyond the dam.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Bull Trout (Continued)	N/A	**Catastrophic failure of the tailings impoundment could result in an irretrievable loss of bull trout.**	**Similar to Alternative II.**	**Similar to Alternative II.**	Risk of catastrophic failure of tailings facility reduced by using paste technology, hence risk to fish is also reduced.
Other T&E species (including proposed species)	Bald eagle use would continue to increase. Mortality risk would remain unchanged.	**Increases in road-killed deer could slightly and indirectly increase mortality risk of bald eagles along MT Hwy. 200, FDR No. 150, and along the train tracks near the Hereford siding.**	Increases in road-killed deer and associated bald eagle mortality risk along MT Hwy. 200 is less than Alternative II because of rerouting concentrate haulers to the Miller Gulch rail loadout along FDR No. 150B and daily removal of road-killed animals.	Same as Alternative III.	Mortality risk is lowest due to additional reductions in traffic on FDR 150 from busing employees between water treatment and mill site facilities.
	Transient wolf would continue to use the Clark Fork River drainage.	Similar to Alternative I.	Same as Alternative II.	Same as Alternative II.	Same as Alternative II.
	Habitat for lynx, would continue to be reduced as fragmentation and habitat degradation continued. Disturbance and mortality risk would continue to increase slowly as regional human population increased.	Lynx habitat quality reduction (especially old growth, riparian areas and travel corridors) and disturbance could displace animals.	Similar to Alternative II.	Moving the mill site and impacting less old growth would reduce the impact below Alternative III.	Change in effectiveness of old growth would be essentially unmeasurable. Mortality risk further controlled through mitigation measures.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Big game animals	There would be no increase in existing animal-vehicle collisions unless there are other increases in use in the Rock Creek drainage from public or private timber sales and as human population in the area grew over time.	Increased potential for animal-vehicle collisions.	Similar to Alternative II.	Similar to Alternative II.	Lowest increased potential for animal-vehicle collisions because busing of employees and reduced open road density would reduce the number of vehicles on the roads and the amount of open roads where collisions could occur.
	Minor changes in habitat or activities of big game animals; security could be improved as open road densities were reduced.	Minor loss of habitat for game species including travel corridors, riparian areas and a few small bull elk wintering areas.	Similar to Alternative II.	Habitat loss associated with the mill in the upper West Fork of Rock Creek would be shifted to the confluence mill site.	Habitat loss is the least of the action alternatives.
	Displacement and possible increased mortality of animals due to increased human development in Rock Creek if Sterling releases its Rock Creek lands.	Displacement and possible increased mortality of animals due to increased human use and activities (including hunting and poaching).	Somewhat less impact because of road closures.	Similar to Alternative III.	Same as Alternative III.
Neotropical migrant birds	Minor changes in forested habitat or activities of neotropical migrant birds unless Sterling releases its Rock Creek lands for development. Increased homesites could decrease bird diversity by introduction of pest species and direct habitat loss.	**Direct and indirect loss of old growth, riparian, and wetland habitats would affect songbirds in those areas. Potential loss of individual birds.**	**Same as Alternative II.**	**Same as Alternative II.**	Substantially similar to Alternative I for old growth and same as Alternative II for riparian and wetland habitat.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Sensitive animal species	Stability of harlequin duck population in lower Clark Fork would remain vulnerable.	**Human disturbance and habitat alteration could result in loss of harlequin duck reproduction on Rock Creek. Loss of Rock Creek breeding area would increase vulnerability of the lower Clark Fork harlequin subpopulation.**	**Impacts to harlequin ducks and their habitat lessened with relocation of FDR No. 150 out of the riparian area but remain potentially significant and similar to Alternative II.**	**Similar to Alternative III.**	Impacts to harlequin ducks and their habitat less than other action alternatives because of busing mine employees, slurrying concentrates and seasonal closing FDR No. 150B, operating limitations, and moving of the evaluation adit support facilities site.
	Habitat for fishers and wolverines would continue to be reduced as fragmentation and habitat degradation continued. Disturbance and mortality risk would continue to increase slowly as regional human population increased.	Fisher and wolverine habitat quality reduction (especially old growth, riparian areas and travel corridors) and disturbance could displace animals. Impacts would not lead to a trend toward federal listing.	Similar to Alternative II.	Moving the mill site and impacting less old growth would reduce the impact to fisher and wolverines below Alternatives II and III.	Change in effectiveness of old growth would be essentially unmeasurable from Alternative I. Mortality risk to fisher and wolverines further controlled through mitigation measures.
	Disposition of lands in Rock Creek by Sterling could increase human development in drainage with resulting impacts to harlequin ducks, fisher and resident birds.	Potential increases in hunting, trapping, poaching, and traffic collision mortality would add to the overall decline of fisher and wolverine security in the Cabinet Mountains, and the region.	Similar to Alternative II.	Similar to Alternative II.	Busing mine employees decreases risk of mortality from vehicle collisions and vehicle disturbance.
	Northern goshawk habitat would increase over time as forests aged.	Direct habitat loss and disturbance to nesting northern goshawks would be greatest of action alternatives.	Similar to Alternative II except fewer acres of nesting habitat lost.	Similar to Alternative III but very little direct loss of nesting habitat. Disturbance effects similar to Alternative III but less.	Direct nesting habitat loss virtually unmeasurable (0.04 acre). Foraging habitat loss least of action alternatives. Disturbance effects least of action alternatives but remain higher than No Action.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Other sensitive aquatic species	Long-term risk to pure strains of westslope cutthroat trout from hybridization with non-native trout	**Slightly increased risk due to increased sediment loading.**	**Similar to Alternative II.**	**Similar to Alternative II.**	Additional sediment mitigation would reduce risk close to no action levels.
Plant species of special concern	Eleven populations of 5 different plant species of special concern within the permit area would remain undisturbed. Crested Shield fern was not found in study area.	Eleven populations of 5 species of special concern would be eliminated.	Eleven populations of 5 species of special concern would be eliminated if they cannot be avoided during construction. If KNF sensitive species cannot be avoided, a conservation assessment must be performed and a mitigation plan may be needed.	Same as Alternative III.	Similar to Alternative III, however a requirement to revisit surveys whenever updated lists of sensitive plant species or MNHP species are prepared would help to reduce or avoid impacts on those new species.
Mountain goats	Habitat effectiveness is 91% in key summer habitat and 100% in winter habitat. Mortality risk would remain as is.	Project-related noise and disturbance would change habitat effectiveness to 85-91% in key summer habitat. Increased mortality risk would occur due to increased human use of the area by recreationists, hunters, and poachers.	Project-related noise, disturbance, and facility location would change habitat effectiveness to 86-93% in key summer habitat. Similar to Alternative II, but additional road closures would reduce mortality risk.	Project-related noise, disturbance, and facility location would change habitat effectiveness to 87-92% in key summer habitat. Similar to Alternative III.	Similar to Alternative IV. Project-related noise disturbance, and facility location would change habitat effectiveness to 86% in key summer habitat. No changes to winter habitat effectiveness. Similar to Alternative III, but mitigation includes increased law enforcement and monitoring to control mortality risk.
Pileated woodpecker	Habitat availability to sustain local populations of pileated woodpeckers would remain below recommended biologically sound levels. Effective old growth currently is 867 acres.	**Effective old growth would reduce 14% (122 acres) to 745 acres, which would potentially significantly affect sustainability of local pileated woodpecker populations.**	**Effective old growth would reduce 5% (47 acres) to 820 acres, which would potentially significantly affect sustainability of local pileated woodpecker populations.**	**Effective old growth would reduce 3% (30 acres) to 837 acres, which would potentially significantly affect sustainability of local pileated woodpecker populations.**	Effective old growth would remain substantially the same, resulting in similar effects as Alternative I.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Impoundment/Paste Facility Stability	No tailings impoundment would be constructed, therefore no risk of failure.	Risk of impoundment failure would be possible but remote. **Impacts from an impoundment failure to surface waters and aquatics would be potentially significant.**	Modified design and construction details as well as a technical panel review of the design would further reduce the risk of impoundment failure. **Same as Alternative II.**	Same as Alternative III. **Same as Alternative II.**	Modified design and use of paste tailings along with a technical panel review of the design further reduce the risk of paste facility failure. **Similar to Alternative II but likelihood of tailings reaching surface would be greatly reduced with paste technology and risk of occurrence would be remote.**
Socioeconomics Employment	Projected increase of 650 jobs (17%) in Sanders Co. & 2000 jobs (22%) in Lincoln Co. between 1995-2020, with all growth occurring in the finance/education/government & service sectors.	**Mine-based direct and secondary employment peaking at 531 during evaluation adit construction then dropping to 143 during mine development and construction. Operating period employment of 497, mostly in resource commodity sector. Possible loss of some Sanders Co. jobs tied to retirement/amenity immigration anticipated under Alternative I. Operating phase duration of up to 30 years, after which most mine-related employment would be lost.**	**Same as Alternative II**	**Similar to Alternative II, but employment during evaluation adit construction would peak at 432 before dropping to 252. Mine operations would provide 476 direct & secondary jobs, for 20 to 30 years.**	**Same as Alternative IV**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Population	Bonner Co. experiencing rapid growth & Sanders Co. moderate growth based on retirement/amenity immigration. Lincoln Co., relatively slow growth.	**Local area immigration peaking at 909 persons then dropping to 467 during construction, before growing to 982 during mine operations. In western Sanders Co. mine-based immigration could be offset by reduced retirement/amenity immigration resulting in minimal population change from Alternative I projections.**	**Same as Alternative II**	**Similar to Alternative II, but construction-related immigration numbers would peak at 772 before dropping to 456. Operations related immigration would be 861. The construction period influx would arrive later in development phase.**	**Same as Alternative IV**
Income	Total area personal income increasing proportional to population growth, with modest gains in per capita income.	**Annual earnings from direct and secondary mine-related employment totaling about $14 million. Net earned income increase in western Sanders County could be minimal, if mine reduces retirement/amenity immigration. Local area would lose this source of income at mine shutdown.**	**Same as Alternative II**	**Similar to Alternative II, but annual earnings from mine-related employment would total about $13.5 million.**	**Same as Alternative IV**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Land Use & Housing	Land use conversion from timber/agriculture to residential/recreation would continue—rapidly in Bonner & western Sanders Co., more slowly in Lincoln Co.	Similar pattern of land use conversion to Alternative I. Mine permit area of about 2,400 acres with about 584 acres of surface disturbance expected. About 3,074 acres of private land dedicated to grizzly bear habitat mitigation.	Similar to Alternative II but about 609 acres of surface disturbance About 2,692 acres of private land dedicated to grizzly bear habitat mitigation.	Similar to Alternative II, but about 542 acres of surface disturbance. About 2,536 acres of private land dedicated to grizzly bear habitat mitigation.	Similar to Alternative II, but about 482 acres of surface disturbance. About 2,350 acres of private land dedicated to grizzly bear habitat mitigation.
		About 400 acres at impoundment site would be unusable for most existing land uses.	Same as Alternative II	Same as Alternative II.	Similar to Alternative II.
		Approximately 3,074 acres of private lands needed for grizzly bear mitigation would be removed from future development.	Approximately 2,692 acres of private lands needed for grizzly bear mitigation would be removed from future development.	Similar to Alternative III except that only 2,536 acres of private lands would be removed from future development.	Similar to Alternative III except that only 2,350 acres of private lands would be removed from future development.
	Housing continuing to be relatively scarce and expensive in Bonner & western Sanders Co., but more available and less costly in Lincoln Co.	**There would be a substantial short-term housing shortage in western Sanders Co.** **During contract construction. Long-term housing for permanent employees would be scarce and expensive. Some workers during both periods would be forced to commute an hour, or more, to the work site.**	**Same as Alternative II**	**Similar to Alternative II, with slightly reduced housing demand during both the construction and operating periods.**	**Same as Alternative IV**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Community Services	Moderate increases in demand for already burdened community services.	Most residential and commercial development would have to use private water supplies & septic systems. Some school systems could experience disruptive effects from the sudden influx & departure of students during mine construction. Facility capacity and accreditation not expected to be at issue. Other public service providers may have difficulty adjusting to changes in demand for services as mine employment fluctuates during development.	Same as Alternative II	Similar to Alternative II, with slightly fewer people needing services and schools than under Alternative I. Schools and other service providers would have more time to prepare for the construction period population influx than they would have under Alternative II. There would also be a slightly smaller departure of people at the end of construction and influx of people for mine operation than under Alternatives II and III. This would lessen the impacts to community services during employment fluctuations.	Same as Alternative IV
Fiscal	Increases in local government revenue from new development probably would not pay the costs of increased service demand.	Sanders County & the Noxon schools receive substantially increased tax revenue. Other local taxing districts receive some revenue from tax base sharing. The Hard-Rock Mining Impact Plan helps to mitigate fiscal problems associated with project impacts.	Same as Alternative II	Same as Alternative II	Same as Alternative II

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Old Growth Ecosystems (excludes replacement old growth)	Approximately 6.2% of Compartment 711 would remain in effective old growth habitat. This percentage would change over time due to natural succession and natural occurrences, (e.g., fire).	**About 122 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 5.3% of Compartment 711.**	**About 47 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 5.9% of Compartment 711.**	**About 30 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 6.0% of Compartment 711.**	Essentially the same as Alternative I.
	Effective old growth habitat would remain below the recommended levels to provide for long-term maintenance of old growth dependent species in Compartment 711 but would increase over time.	**Biological diversity would be reduced and long-term occurrence of old growth dependent species would be unlikely.**	**Similar to Alternative II, except the likelihood of long-term maintenance of old growth dependent species is improved over Alternative II.**	**Similar to Alternative II, except the likelihood of long-term maintenance of old growth dependent species is improved over Alternative III.**	Essentially the same as Alternative I.
Wetlands and Non-wetland Waters of the U.S. Wetlands & riparian zones	Wetland and riparian zones could be disturbed by timber sale roads and development of private lands.	**A total of 9.6 acres of wetlands and non-wetland waters of the U.S. would be disturbed by the project.**	**About 7.7 acres of wetlands and non-wetland waters of the U.S. would be affected.**	**Less than 6.6 acres of wetlands and non-wetland waters of the U.S. would be disturbed.**	**Similar to Alternative IV.**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Wetlands & riparian zones (Continued)	N/A	**Functions and values may decrease until the 13.8 acres of wetlands and non-wetland waters of the U.S. mitigation sites were established.**	**Similar to Alternative II but only 10.5 acres of wetlands and non-wetland waters of the U.S. mitigation sites have been identified.**	**Same as Alternative III.**	**Similar to Alternative II, about 10 acres of wetlands mitigation sites are proposed to be created (1.5:1 ratio) within the 18.9 acres identified for potential mitigation.**
	N/A	< 1.5 to 1 acre wetland mitigation ratio	< 1.5 to 1 acre wetland mitigation ratio	> 1.5 to 1 acre wetland mitigation ratio	> 1.5 to 1 acre wetland mitigation ratio
Springs and Seeps and Wilderness lakes	N/A	**Aquatic life, wetlands, and riparian areas associated with Cliff and/or Copper lakes could be significantly impacted by lake drainages or changes in water chemistry if subsidence or drainage-induced habitat stresses occurred. Acres that would be affected are not known and could vary depending on effect on lake water levels and water chemistry.**	**Potentially significant, short-term impacts to wetlands and aquatic life associated with Cliff and/or Copper lakes would be mitigated in accordance with a mitigation plan if subsidence occurred.**	**Same as Alternative III.**	**Similar to Alternative III. 1,000-foot buffer zones around Cliff Lake and the ore outcrop zones and 450-foot vertical buffer between mine workings and surface should avoid impacts to wilderness lakes, springs, and seeps and associated vegetation. Monitoring of the vegetation along with water resources monitoring should help to identify if impacts were occurring and help identify possible mitigations if necessary.**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Transportation					
Public access	Public access for hunting, fishing, hiking and other recreational activities would remain the same.	There may be delays and temporary road closures during road construction and reconstruction.	Similar to Alternative II.	Similar to Alternative II.	Similar to Alternative II.
		N/A	FDR No. 150B between Engle Creek and Government Mountain Road west would be restricted to mine-related traffic.	Same as Alternative III.	FDR No. 150B would be closed during operation between Engle Creek and paste plant.
	N/A	Paving of FDR No. 150 and widening of FDR No. 2741 would improve year-round public access to the CMW and for general recreational activities.	Same as Alternative II.	Public access from FDR Nos. 2741 and 150 above the confluence of the east and west forks of Rock Creek would remain similar to Alternative I.	Similar to Alternative I.
	KNF would use roads on an as needed basis but none proposed.	KNF would need to close 5.28 miles of road (1.88 mi. of FDR No. 2741-Chicago Peak Rd., 0.18 mi. of FDR No. 2741x, 0.5 mi. of 2741A, and 2.71 mi. of FDR No. 2285-Orr Gulch Rd.)	Same as Alternative II but 4.18 miles - would close 1.61 miles of Orr Gulch Rd.	Same as Alternative III.	Similar to Alternative III, but close 5.22 mi. of road (2.92 mi. of FDR No. 150, closed and not close 1.88 mi. of FDR No. 2741)
Traffic safety	Traffic volumes and accident risk would grow or decline with population changes, timber sales, and development of private lands.	The average daily traffic (ADT) for Montana Hwy. 200 would increase by 71 percent during construction and by 38 percent during mine operation. The ADT for FDR No. 150 also would increase by 2,800 percent and 1,440 percent, respectively. This would increase the chances for traffic-related accidents on these roads.	ADT would remain essentially the same as in Alternative II. Any carpooling would reduce ADT.	Similar to Alternative III, except that ADT on FDR Nos. 150 and 2741 above the confluence of the east and west forks of Rock Creek after evaluation was completed would be similar to Alternative I.	ADT on Hwy 200 would be the same as Alternative II. With busing of mine employees, the ADT on FDR No. 150 would increase 1,100 percent over Alternative I during construction and 200 percent during mine operation. Above the mill site, the traffic would be similar to Alternative I.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Traffic Safety (Continued)	Traffic to Hereford rail siding and Government Mountain (FDR No. 150) would remain at existing levels.	Slow moving ore concentrate trucks traveling to and from the Hereford rail loadout would be turning onto and off the Montana Hwy. 200. This would create additional hazards to higher speed highway traffic and residential traffic at Hereford.	Ore concentrate truck traffic would be eliminated from Montana Hwy. 200. ADT on FDR No. 150B from Engle Creek to the Miller Gulch rail loadout would show a slight increase.	Same as Alternative III.	Ore concentrate would be slurried from mill to rail loadout thus eliminating the need for concentrate trucks.
	N/A	Road alignment of FDR No. 150 and MT Hwy. 200 intersection could increase potential for accidents.	FDR No. 150 and Montana Hwy. 200 intersection location complies with state standards and would not increase potential for accidents.	Same as Alternative III.	Same as Alternative III.
Aesthetic Quality Noise	Existing noise levels in the Rock Creek drainage and Clark Fork Valley would be maintained except for changes associated with timber sales and private land development.	Blasting during adit construction would generate sounds up to 125 dBA within 900 feet of the blast and up to 80 dBA within the Clark Fork Valley and the CMW. Construction equipment would generate sounds up to 110 dBA within 50 feet.	Similar to Alternative II except that sound mitigations to construction equipment could reduce noise levels.	Same as Alternative III except that moving the mill to the confluence would increase the buffer between the mill/mine operations and the CMW to 1.25 miles. Operational noise levels would be about 35 dBA at the CMW boundary.	Same as Alternative IV.
		Mine operation noise levels of 52-62 dBA are lower than construction noise levels but still greater than premine conditions and would generally be inaudible in Clark Fork Valley.	Implementation of sound mitigations (e.g. reduce backup beeper volumes, dampen exhaust and intake fan, and retain vegetative buffers) would reduce operation noise levels.	Same as Alternative III.	Same as Alternative III.
		Traffic related noises would significantly increase on FDR No. 150 from 30 to 70 dBA.	**Similar to Alternative II.**	**Similar to Alternative II.**	Busing of mine employees would reduce traffic frequency by 72 percent compared to Alternative II. This would in turn reduce the frequency of traffic-related noise.

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Noise (Continued)		**Activities at the Hereford rail loadout facility would generate noise up to 87 dBA daily between 8 a.m. and midnight. This would increase noise levels to residences in the area.**	Noise-related impacts to Hereford residences would be avoided by moving the rail loadout to the Miller Gulch site. Sound levels at Miller Gulch would be similar to those at Hereford (Alternative II), but there are no nearby residences that would be impacted.	Same as Alternative III.	Similar to Alternative III but enclosure of the rail loadout facility would tend to muffle noise levels.
		Ventilation fans would operate continuously at about 123-96 dBA and would be heard at about 45 dBA up to a mile away (450 acres) for the last 15-20 years of mine operation. This would significantly affect the solitude expected by people visiting the area of the CMW near the adit.	Relocation of the air intake ventilation adit and sound mitigations for the ventilation fans would reduce the noise level to 30 dBA within 100 feet of the adit, and affect an estimated 12 acres. This reduces the impact to CMW visitors.	Same as Alternative III.	Same as Alternative III.
Scenic quality	Visual character of the Rock Creek drainage and the Clark Fork Valley would be retained.	**Significant impacts to Rock Creek drainage and Clark Fork Valley from project features during construction and operation.**	**Significant impacts somewhat reduced by painting or staining mill facilities and immediate revegetation of cut slopes and waste rock dumps.**	**Similar to Alternative III except impacts at confluence mill site further reduced by visual buffer along FDR No. 150 and immediate revegetation of mill pad face following construction.**	**Same as Alternative IV.**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Scenic Quality (Continued)		**Impoundment visibility would significantly impact travelers on MT Hwy. 200 due to lack of screening and postponement of planting trees until after mine closure and topographic changes.**	Impoundment visibility along MT Hwy. 200 reduced by planting vegetative screen and concurrent planting of trees and shrubs after year 7 of impoundment construction.	Same as Alternative III.	Paste facility visibility along Montana Hwy. 200 reduced by vegetative screen. Phased reclamation of deposit incrementally reduces deposit visibility, but effectiveness varies with deposition options.
		Impoundment surface highly visible in background for CMW users on high trails and peaks.	Similar to Alternative II, but long-term visibility reduced due to changes in revegetation plan.	Same as Alternative III.	Same as Alternative III.
		Utility corridor visible to people using FDR No. 150 except for cross country sections.	Utility corridor more visible because it follows the road.	Similar to Alternative III but shorter length.	Similar to Alternative III but all pipelines buried except at stream crossings.
	Forest Plan and Visual Management System (VMS) Visual Quality Objectives (VQO) would be used for future timber sales or other KNF management activities.	**The prescribed VMS VQOs would be impossible to achieve during mine life, but revised Forest Plan MAs would have no life-of-mine VQOs.**	**Same as Alternative II.**	**Same as Alternative II.**	**Same as Alternative II.**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Scenic Quality (Continued)		**The impoundment surfaces could potentially never meet VMS Retention or Partial Retention VQO standards.**	**Additional reclamation requirements would increase the likelihood the impoundment surface would achieve VMS VQO standards within several decades.**	**Same as Alternative III.**	**Same as Alternative III.**
		The mill site and utility corridor would achieve the Forest Plan VQO of Partial Retention several decades after mine closure.	**Additional plantings for screening, concurrent planting of trees and shrubs on impoundment face after year 7 of construction, and other additional reclamation requirements would shorten the amount of time needed for mine facilities to achieve Forest Plan VQO standards, but it would still take decades.**	**Similar to Alternative III, except that the elimination of the separate waste rock dump, immediate planting of the mill pad face, and the visual buffer would further help the site achieve Forest Plan VQO standards after several decades.**	**Similar to Alternative IV for the confluence mill site. Final reclamation that would occur yearly on the front face of the paste deposit (with bottom up construction) would help achieve Forest Plan VQO standards sooner than Alternatives !!-!V, but it would still take decades.**

TABLE 2-23 (Continued)
Summary Comparison of Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES				
	I (No Action)	II (Proposed Rock Creek Project)	III (Project With Mitigations)	IV (Modified Project With Mitigations)	V (Paste Facility & Alternative Water Treatment)
Wilderness	Current wilderness experience remains unaffected.	**The wilderness air intake ventilation adit would be highly visible and audible to recreationists using the CMW within 2,500 feet of the adit. The adit would significantly affect the wilderness experience of those users (see Noise above).**	Placing the air intake ventilation adit in a more vertical slope could increase its visibility, but would reduce the area of disturbance around the adit. Additional reclamation requirements would reduce the visual impacts of the adit after mine closure. Sound mitigations would reduce the noise-related impacts to humans and goats to a 100-foot radius around the adit.	Same as Alternative III. Same as Alternative III.	Same as Alternative III. Same as Alternative III.
Forest Plan *	No changes needed	Total acres reallocated to: MA 31, Mining - 143 MA 23, Utilities - 46 MA 11, Big game winter range - 12 **Total acres changed = 201**	Total acres reallocated to: MA 31, Mining - 135 MA 23, Utilities - 51 MA 11, Big game winter range - 11 **Total acres changed = 197**	Total acres reallocated to: MA 31, Mining - 110 MA 23, Utilities - 38 MA 11, Big game winter range - 10 **Total acres changed = 156**	Total acres reallocated to: MA 31, Mining - 108 MA 23, Utilities - 39 MA 11, Big game winter range - 0 **Total acres changed = 147**

Notes:

* Forest Plan = Not an environmental issue but a KNF management issue, these management area reallocations would occur only on project approval. Environmental impacts are addressed in specific resource sections.

[1] All significant or potentially significant impacts are in **bold text**. For more detail, see Chapter 4.

Prediction of the precise hydrogeologic effects of mine development within a fractured bedrock aquifer is extremely difficult even if numerous monitoring wells are available and the subsurface geology is well known. However, a conceptual scenario of ground water movement has been developed (MT DEQ 2001a) and a summary is provided below.

Void spaces created by underground mining tend to interconnect previously isolated fractures and faults. Prior to mining, some of these structures would have been conduits for ground water while others would not have been connected to sources of recharge and would therefore have been dry or would not have been paths of significant flow. Mining can drain fractures, possibly resulting in loss of flow at pre-existing springs, and can also re-direct water into previously dry fractures, resulting in the formation of new springs. The locations of underground fractures and their relationships to surface features such as springs are frequently impossible to determine prior to mine development. Therefore, effects on springs and seeps cannot be predicted precisely for any action alternative.

Depending on the actual impacts detected during mining, complete plugging of the mine at closure may be preferable or maintenance of mine dewatering after closure may be preferable. Complete plugging of the mine would help to reestablish the pre-mining static head in the bedrock aquifer and reduce ground water drainage stresses on overlying lakes and streams. However, adit plugging could also increase hydraulic gradients and hydrofracturing potential, exacerbating post-mining leakage of mine water to the surface. Continued mine dewatering could reduce the potential of leakage to downgradient streams, but would maintain any mining-induced groundwater drainage stresses on overlying lakes and streams.

With the Rock Creek ore deposit, these factors of uncertainty are compounded by the deposit's location. Drilling monitoring wells within the wilderness would require an unreasonable amount of disturbance and environmental impacts due to the topography (very steep slopes and rock faces) above the deposit. Under Alternative V additional hydrogeologic data would become available during development of the evaluation adit. Piezometers could be drilled into the bedrock aquifer from the underground workings as they advance. Hydraulic conditions within fault zones and under lakes and streams would be targeted for monitoring. Even without such data, however, it can reasonably be predicted that mining could reduce flows at some springs (mostly above the ore deposit) and will likely increase flows at other springs downgradient of the deposit. Under Alternative V, this data would be used to determine the most appropriate means of adit closure.

Construction of the mill pad, roads, and waste rock dumps would temporarily increase the amount of suspended sediment and nitrogen loads of Rock Creek for Alternatives II and III. The concentration of nitrogen cannot be estimated with certainty and would depend upon the amount of nitrogen contamination of the waste rock, climate, infiltration beneath the mill pad, starter dams, and waste rock piles, and amount of surface runoff circumventing containment barriers and diversion structures. Aquatic invertebrates could be significantly impacted from increased nitrates in the short term. Impacts to aquatic plant communities or algae would be potentially significant in the short term from increases in nitrogen. Alternative III mitigations would reduce sediment loads in Rock Creek lessening the impacts to aquatic life. For Alternatives IV and V, suspended sediment produced from construction of the mill facility, and residual nitrogen from blasting would not affect the West Fork of Rock Creek because the mill would be located farther downstream, there would be less road construction/reconstruction, and there would be no separate waste rock dump although waste rock would be used for mill pad construction under Alternatives IV and V. The 300-foot wide stream buffer around the confluence mill site would further reduce sediment impacts to lower reaches of Rock Creek under

Alternatives IV and V. A sediment abatement effort on 130 acres of NFS lands in Rock Creek and/or Bull River watersheds in Alternatives III and IV or the elimination of 400 tons of sediment per year in the Rock Creek drainage would offset expected short-term sediment effects, with the greater estimated reduction under Alternative V.

Impacts to aquatics and fisheries from spills and/or pipeline ruptures could be potentially significant for all action alternatives. The potential for spills to reach surface waters would be somewhat reduced due to consolidation of utility and road corridors and the relocation of the lower portion of FDR No. 150 away from Rock Creek. The potential for spills and rupture would be further reduced by burial of the pipelines under Alternative V. Relocating the mill to the confluence of the east and west forks of Rock Creek under Alternatives IV and V would eliminate the potential for materials from spills and pipeline ruptures to reach the West Fork of Rock Creek.

Changes in ground water quality for all four action alternatives would, for the most part, be restricted to an approved ground water mixing zone that must be approved by DEQ. Under all action alternatives, only nitrates and dissolved manganese would exceed Montana's standards (manganese exceeds the standard in ambient ground water) within the mixing zone. Clays removed for dam stability purposes in Alternatives III through V would be used to seal more permeable areas such as the colluvium at the north end of the impoundment. An engineered perimeter drain and ground water extraction well system would collect and pump seepage back to the tailings impoundment and prevent changes in ground water quality outside of the mixing zone for Alternatives II through IV. Discharge of tailings impoundment seepage to Rock Creek, Miller Gulch, and the Clark Fork River would be nearly eliminated. Frequent monitoring from associated compliance wells would be required to determine the effectiveness of the system and whether or not additional pump-back wells would be needed for Alternatives II through IV or whether a pump-back system needs to be added for Alternative V.

Sterling's water monitoring plan would be expanded for Alternatives III through V and would include a Monitoring Alert Levels and Contingency/Corrective Action Plan. This plan would ensure early detection of potential environmental degradation or impairment and would focus primarily on the protection of surface and ground water resources. The intent of this additional plan would be to prevent pollution and other problems before they occurred. The water monitoring plan would be coordinated with the fishery/aquatics monitoring plan and wetlands mitigation and monitoring plans.

Surface and Ground Water Quantity. Surface water runoff in Miller Gulch would decrease during the life of the project but would impact downstream users. It likely would return to near normal levels after reclamation was complete and when surface water on the impoundment could be discharged into the drainages. The decrease in runoff cannot be quantified but would be greatest during spring runoff and heavy rains throughout the year.

No measurable impacts to streamflows in Rock Creek or the Clark Fork River are predicted under any alternative. However, there is a small probability that surface water flows from springs located around the ore body and adit could be reduced due to project activities. There would be some reduction in ground water flows down gradient from the impoundment due to the extraction wells for Alternatives II through IV. Once the impoundment seepage and ground water quality under the impoundment returned to premine water quality levels, the extraction wells would be turned off. This would allow ground water flows to return to premine levels. Impacts to ground water flows under Alternative V would be negligible unless a pump-back system becomes necessary.

Wilderness Lakes and Wetlands. Sterling proposes to leave a minimum of 100 feet of overburden between mine workings and the ground surface under Alternative II. However, under Alternative V, the vertical buffer between the workings and the surface would be increased to 450 feet and a 1,000-feet horizontal buffer would be required around Cliff Lake, Moran Fault, and the ore outcrop zones. In the vicinity of Copper and Cliff lakes, in excess of 900 feet of overburden exists. Given this thickness of overburden and the inherent strength of the rock, the potential for fracturing and subsidence are extremely remote. Regardless, rock mechanics data from the evaluation adit and mined areas would be required for Alternatives III through V. These data along with operational hydrostatic pressure data would be used for the Agencies' evaluation and approval of updated mine plans prior to mining under the lakes or near outcrop zones. Impacts to wilderness lakes, wetlands, and associated aquatic life from subsidence would be potentially significant for all action alternatives although the potential for subsidence or impacts to the water level or water balance of the lakes would be extremely remote especially under Alternative V. Disruption of ground water supply to lakes, streams, and wetlands is possible (MT DEQ 2001a) under Alternatives II-IV and much less likely under Alternative V.

A contingency plan would be developed to mitigate impacts to the lakes and any associated wetlands to comply with the 404(b)(1) permitting process.

Changes to Wildlife, Habitat, and Threatened and Endangered Species

Grizzly Bears. The proposed project would physically alter habitat due to the construction of mine facilities (584 acres under Alternative II, 609 under Alternative III, 542 under Alternative IV, and 482 under Alternative V). Additional habitat effectiveness would be significantly reduced due to increased human activity. The reduced habitat effectiveness would be greatest during the construction phase; Alternative II would impact the greatest area (8,196 acres) and Alternative V would impact the least area (7,044 acres). Reduced habitat effectiveness would be less during mine operation; Alternative II would impact 7,308 and Alternative V would impact 6,428 acres.

The increased mortality risk from vehicle-bear collisions, poaching and destruction of nuisance bears could reduce the existing grizzly bear population. Behavior of bears whose territories include the permit area could be modified. Bears could be displaced, feeding patterns could be disrupted, and breeding success interfered with.

The existing Forest Plan standards for grizzly bear management on the KNF have been designed to provide the necessary components for a recovered grizzly bear population (a minimum mortality risk, adequate food supply, spatial distribution of habitat and grizzly bears) across the Cabinet-Yaak ecosystem (CYE). The existing bear management standards are not being met in Rock Creek and the adjacent area. The proposed project would result in a further decrease in the grizzly bear standards for Rock Creek and the surrounding area.

The recent bear management approach to meet Forest Plan standards has been to restrict vehicle use on 6.9 miles of road in the Rock Creek drainage. Alternative II would result in closure of 5.28 miles of road to meet the 0.75 miles of open road per square mile standard for bear analysis areas. Alternatives III and IV would result in closure of 4.18 miles of road to comply with this standard, while 5.22 miles would be closed for Alternative V. These additional closures would not eliminate all the project impacts, but would reduce them. The significance of the impacts is based not only on the need to minimize effects, but on the mandate of the Endangered Species Act to "conserve and recover" the species. To reduce the significance, other mitigation is required that is designed to maintain suitable habitat levels.

This mitigation would be phased in over the start up period, commensurate with activity levels, and be fully in place prior to the start of full operations. Mitigation may not prevent incidental taking, therefore, the action alternatives may adversely affect the grizzly bear.

The Threatened and Endangered Species Mitigation Plan for Alternative V incorporated all components of the Reasonable and Prudent Alternative, the Reasonable and Prudent Measures, and the Terms and Conditions identified in the USFWS Biological Opinion. All these items would be necessary to preclude jeopardy to the grizzly bear. Without implementation of these requirements, USFWS has determined the project would jeopardize the continued existence of grizzly bears in the CYE.

Bull Trout. Action Alternatives II, III, and IV would impact resident populations of bull trout in Rock Creek by increasing sediment loads from road construction and runoff. Sediment mitigations contained in Alternatives III, IV, and V should offset some of these impacts. Rock Creek already has a high level of fine sediment in some spawning gravels. Increased sedimentation could significantly reduce fry emergence and potentially lead to reduction of this fish population due to reduced spawning success. Since Rock Creek is one of the major spawning areas for the Cabinet Gorge metapopulation, degradation of Rock Creek bull trout spawning habitat could significantly impact this population. Alternative V would minimize these impacts in the short-term and eliminate them in the long-term by implementing an aggressive sediment mitigation plan which would decrease sediment loading below present conditions.

Alternatives II and III would impact spawning habitat and resident bull trout populations the entire length of Rock Creek from the upper mill site to the Clark Fork River. To the limited extent that the migratory form of bull trout is present in Rock Creek, these two action alternatives could have the greatest potential impact to the Cabinet Gorge bull trout population. However, under Alternatives III through V, the identification and reduction of existing sediment sources in the Rock Creek drainage by Sterling prior to mine construction would help offset short-term increases in sediment due to facility construction. These mitigations could reduce project-related impacts to the Cabinet Gorge Reservoir bull trout population. BMP and reclamation monitoring would help to identify what mitigations were ineffective or less effective in reducing sediment and help to determine what additional measures would be needed to achieve the desired sediment reduction goals.

Moving the mill site to the Rock Creek confluence (Alternatives IV and V) reduces project-related impacts to populations of bull trout in the West Fork of Rock Creek as well as reducing sediment impacts to spawning habitat and fish populations in Rock Creek below the confluence with its east fork. However, localized increases in fine sediment loading during project construction are likely to adversely affect bull trout individuals.

Under Alternatives II, III, and IV, catastrophic failure of the tailings impoundment could result in an irretrievable loss of resident bull trout. The risk of catastrophic failure would be greatly reduced by using paste technology (Alternative V).

Additional mitigation were incorporated into Alternative V as a result of the USFWS Biological Opinion. Barriers would be installed at stream crossings to reduce the risk of a vehicle and its contents from reaching Rock Creek in case of an accident. Also, Sterling would work with FWP and USFWS to study how bull trout migrated past the diffuser to determine it its design would need to be modified so that the fish could migrate past the diffuser to Noxon Dam.

Water Howellia. Since this species was not found to be present during surveys and since suitable habitat was not found in the project activity area, there will be no direct, indirect, or cumulative effects to Water Howellia or its habitat from any alternative.

Other Terrestrial Threatened and Endangered or Proposed Species. The increased risk of road-killed deer could increase the potential for vehicle collisions with feeding bald eagles along Montana Highway 200 and the railroad. Mitigations for Alternatives III through V include removal of road-killed deer from road rights-of-way. This, in conjunction with busing employees and eliminating the trucking of concentrates, would significantly reduce potential impacts to bald eagles.

Although there are no confirmed sightings of gray wolves within the Rock Creek drainage, suitable habitat would be destroyed and/or rendered ineffective by proposed project activities for all action alternatives. However, the effects are insignificant as suitable den and rendezvous habitat are not present in the Rock Creek drainage which means the likelihood of wolves being residents in the project area is very low.

Lynx is now listed as a threatened species. Lynx habitat would not be significantly affected in any alternative, and none of the alternatives were expected to have a measurable impact on lynx. Mortality risk due to increased trapping pressure may occur; this is under management control should impacts be considered unacceptable in the future. Indirect effects of increased human development attributable to the project may decrease the ability of the low elevation Noxon area to be used as a long distance dispersal corridor. However, the corridor is currently significantly compromised from existing human developments and the incremental decrease in effectiveness of the corridor attributable to the project's effects are probably negligible.

Big Game Animals. All action alternatives would cause disturbances that could displace big game (deer, elk, moose, and black bear) during part of or all of mine life. Some big game habitat, including travel corridors, riparian areas and a few small bull elk wintering areas, would be altered or destroyed due to construction of mine-related facilities. The increase in traffic, particularly along FDR No. 150, would result in more animal-vehicle collisions. Due to increased human knowledge and use of the area there likely would be more hunting and poaching pressure. Alternatives III through V mitigations would reduce some habitat loss and disturbance, but the overall effects would be similar among all action alternatives. Reclamation and revegetation plans (see Appendix J) for Alternatives III through V would be designed to avoid attracting big game during mine life to help reduce potential problems from big game interfering with reclamation and to avoid creating a mortality risk for the animals. The increased use of native plant species would help achieve the long-term reclamation goal for wildlife habitat restoration.

Neotropical Migrant Birds. The loss of older forests (including old growth habitat) and riparian habitats (Alternatives II through IV) would affect neotropical migrant birds (birds that seasonally migrate from tropical areas such as Mexico to North America). Habitat would be converted primarily to open grass communities, disturbed sites (such as borrow areas and tailings impoundment), or artificial areas (such as roads and buildings). Reclamation and revegetation plans for Alternatives III through V would create a more diverse vegetative habitat that would better replace lost or disturbed habitat than under Alternative II.

Sensitive Animal Species. All action alternatives could have significant to less than significant impacts on some sensitive species in the short or long term. Alternative I would have the least impact; although the development of Sterling lands along Rock Creek if the company sold its lands, could have significant impacts on the harlequin duck. The action alternatives would generally decrease in impact from Alternative II through Alternative V. Indirect effects from increased human development in the surrounding Lower Clark Fork and Bull River valleys would be the most significant, unavoidable impact to most species considered.

The most significant impact would be to harlequin ducks in Alternatives II, III, and IV, where impacts would cause a trend towards federal listing under the Endangered Species Act. Alternative V incorporates mitigation to prevent or avoid impacts such that this trend would not be expected to occur. The impacts to harlequin ducks would be from disturbance from mine-related activities, habitat loss or alteration, water quality impacts, and the risk of a hazardous material spill. Indirect impacts as noted above would also affect harlequins, particularly along the other streams of the Lower Clark Fork subpopulation.

While fisher habitat would be reduced, fisher habitat is widespread on the Kootenai National Forest. Fishers do not appear to be limited by availability of suitable habitat. The habitat loss and increase in mortality risk decreases in impact from Alternative II to Alternative V. The most important key habitat, old growth, is not measurably affected in Alternative V. Mitigation features incorporated into Alternative V would reduce impacts to less than significant. All action alternatives were determined to potentially impact individuals but would not result in a trend towards federal listing of fishers under the Endangered Species Act.

Wolverine habitat would not be significantly affected in any alternative. Because wolverine are wide-ranging animals, the indirect impacts of increased disturbance and increased human development may increase mortality with all action alternatives. Mitigation proposed for grizzly bear would likely be effective in reducing the impacts of disturbance and increased mortality risk, and alternatives with mitigation proposed for grizzly bear would have the least impact. The effects of all the action alternatives were determined to possibly impact individual animals but would not result in a trend towards federal listing of wolverines under the Endangered Species Act.

The increased traffic levels along FDR No. 150 may very slightly increase traffic-related mortality risk to Coeur d'Alene salamander. This level of mortality risk is unlikely to reduce viability for this species because the likelihood of occurrence is considered extremely remote. The action alternatives were determined to possibly impact individuals but would result in a trend towards federal listing. Of the action alternatives, Alternative V has the least risk because of decreased mine-related traffic.

Habitat for northern goshawks would be affected in action alternatives, with direct loss of nesting habitat greatest in Alternative II with 25 acres, followed by Alternatives III and IV with 19 and 1 acres, respectively. Alternative V would remove less than an acre of suitable nesting habitat. All action alternatives would increase the disturbance in the area to goshawks, with effects varying depending on the location of the mill site and the mitigation measures. Alternatives II and III cause disturbance from the mill site because of the configuration of suitable nesting habitat, and Alternatives IV and V would have less impact but would still cause disturbance. Alternative II has the greatest disturbance impact, decreasing in impact through Alternatives III, IV, and V

None of the other sensitive species analyzed were determined to be measurably impacted by the project.

Sensitive Aquatic Species. Pure strains of native westslope cutthroat trout in Rock Creek are at risk from all alternatives, including no action. The risk is slightly increased in Alternatives II, III, and IV due to potential habitat degradation. The pure strain will continue to be diluted by interbreeding with non-native trout. There is no possible mitigation for this outcome.

Plant Species of Special Concern. All action alternatives would disturb or eliminate within the project boundary eleven populations of five plant species of special concern which includes one KNF sensitive plant species. Field verification of population locations would be conducted during field road alignment (to finalize road layout and design) for all action alternatives. Minor road alignment changes could result in avoiding some sensitive plant species populations. If KNF sensitive plant species cannot be avoided, Sterling would have to conduct a conservation assessment. Sterling would have to review surveys whenever lists of KNF sensitive species or MNHP species are updated. If those new plants are found or suitable habitat exist, then new mitigations would be developed to avoid the populations whenever possible.

Mountain Goats. All action alternatives could result in a decline in the Rock Peak goat herd due to increased disturbance, mortality risk and loss of habitat effectiveness. Disturbance could stress goats leading to declining health and reproductive vigor.

Mine-related disturbance would reduce mountain goat habitat effectiveness on up to 990 acres during construction (Alternative IV) and up to 530 acres during operation (Alternative II). Noise mitigations proposed under Alternatives III, IV, and V would substantially reduce noise and related impacts around the wilderness air intake ventilation adit which is located in important summer habitat. Road closures proposed for several alternatives would result in an increase of habitat effectiveness of up to 549 acres during the operations phase (Alternative V).

Increased access and human recreational use of the area also would increase disturbance and mortality risk. Goat mortality due to poaching and hunting would likely increase as a result. Road closures for grizzly bear mitigation would reduce these impacts.

Impacts on the Rock Peak herd would be compounded when impacts from Noranda also are considered. The shifting of animals out of the Rock Creek and Ramsey Creek drainages into the CMW from either side could increase the stress of the displaced animals. It also could increase the use of unaffected summer ranges creating potential conflicts with resident goats in the CMW.

Pileated woodpecker. Alternatives II, III and IV would have a potentially significant effect on local populations of the pileated woodpecker. This impact would be caused by direct habitat loss or reduced habitat effectiveness on 122 to 30 acres (Alternatives II to IV, respectively). The anticipated small stand size, lower habitat quality, and limited quantity of habitat would affect sustainability of local populations. Alternative V would not measurably affect pileated woodpecker habitat.

Impoundment/Paste Facility Stability

Tailings would be disposed in an impoundment located just west of the lower reach of Rock Creek under Alternatives II through IV. Conceptual impoundment designs were developed assuming a 7.0 earthquake along the Bull Lake Fault 16 miles away. Under Alternative II, the applicant proposed constructing the impoundment using the upstream method. The modified design for Alternatives III and IV specifies the centerline method for 7 years and the upstream method for the remainder of mine operation. The modified design also would include compacting the tailings beach, possible removal of soft clays under the starter dams, and constructing a concrete shear wall under one of the starter dams to reduce the risk of impoundment failure. Although either impoundment design would be subject to review and approval by the Agencies, the modified design for Alternatives III and IV also would be subject to a technical panel review including a review of a feasibility study on the use of alternative methods to reduce seepage. Failure of the impoundment, while a remote possibility, would have a significant impact to surface waters and aquatics/fisheries.

Alternative V incorporates paste technology as the tailings management option. Under this alternative, the tailings would be dewatered to approximately 20% water by weight (vs. approx. 50% by weight under Alts. II-IV), resulting in a material similar in consistency to stiff cement. The paste tailings would be placed via a pipeline system starting either near the perimeter of the proposed impoundment footprint (Bottom-Up approach) or near the top of the final estimated impoundment height (Top-Down approach). The final configuration of the tailings embankment would be achieved through working the slopes with machinery to achieve the desired aesthetic result. The paste is capable of being reworked due to its lower overall moisture content and resulting higher strength characteristics. In addition to having increased strength, the paste also has a higher viscosity than the "wet" tailings in Alternatives II - IV. The paste then has less tendency to flow when it is not contained, and hence a failure of a paste slope would not result in the kind of tailings run-out which could be expected from a "wet" impoundment. While the likelihood of failure of a paste impoundment is considered negligible (less than 1 in 1 million chances of occurring), there would be an impact to surface waters and aquatics/fisheries should the paste reach a surface water source. This impact has been defined as having a short-term irreversible impact and a long-term excursion of water quality. The final design for the tailings paste facility would be subject to a technical panel review as required for the impoundment under Alternatives III and IV.

Changes in Socioeconomics

Employment, Immigration, and Income. Mine construction would create up to 530 mostly short-term jobs in the local area (western Sanders County, southern Lincoln County, and eastern Bonner County in the vicinity of Clark Fork) and bring in a sudden influx of up to 910 migrants. Roughly 390 of these workers would be laid off when contract construction ended a few months later, causing an exodus of up to 440 people. Employment would then climb to about 500 direct and secondary employees at full mine production, earning a total annual income of approximately $14 million and producing a net local area immigration of up to 980 people. In western Sanders County competition for housing, employees, and services could cause population, employment, and income gains from the project to be at least partially offset by losses in other sources of immigration and economic sectors. Most of the mine-related jobs and income would be lost in a short period at mine shutdown, causing a significant downturn and period of adjustment for the local economy.

Housing. Housing is already in short supply and expensive in western Sanders County and the Clark Fork area of Bonner County, Idaho. Rental units and other short-term housing are especially scarce. Mine development would create a definite housing shortage in this area with the greatest deficiency being short-term housing for contract construction workers. The Troy and Libby areas in southern Lincoln County have greater housing availability, and many workers would live in those communities and commute to the project site. Housing scarcity and cost increases could impact people on fixed or limited incomes. After mining operations ceased, there might be a housing surplus in the area.

Community Services. The suddenness of the contract construction employee and population influx, followed about a year later by an equally sudden exodus, would create a difficult situation for local service providers (schools, law enforcement, emergency, etc.). Demand for their services would suddenly escalate and then would fall off again until the mine reached full production employment. Under the Rock Creek Hard-Rock Mining Impact Plan (ASARCO Incorporated 1997b) local government service providers would receive fiscal assistance in the form of grants and pre-paid taxes to help them deal with mine-generated changes in demand. This fiscal assistance would be valuable but would not solve all the staffing and operating difficulties the providers would face. School systems, in particular could find the fluctuations and turnover in student populations to be a disruptive factor. However, because most area schools are expected to have declining enrollments in the coming years (assuming no mine development), actual capacity or accreditation problems should not arise.

Combined Effects. If the Troy Mine were to reopen and the Montanore Project were to resume development in the same time frame as Rock Creek began development, the socioeconomic effects in western Sanders County and the Clark Fork area would be much greater than those described above. Southern Lincoln county would be able to meet the housing, labor, and community service demands of the Troy and Montanore projects but would have little left to contribute to meeting Rock Creek demands. Western Sanders county would experience a classic boom town situation, with immigration numbers, and demands for housing and services substantially greater than those described above. Very careful planning and preparation by the applicant and local government would be required to manage the situation.

Fiscal. This project would generate direct increases in property tax revenue to local governments; this would peak at about $600,000 for Sanders County during the second year of production. Additional revenues would be generated by the Gross Proceeds Tax and the Metal Mines License Tax (estimated to be a maximum of $300,000 in Sanders County). Increases in personal property and income taxes would occur as a result of increased employment, personal property taxes, and purchase of local services and merchandise. The applicant's Hard Rock Impact Plan would allocate these tax revenues to more closely match the timing and scope of increased local demands for government services (see above). This plan has been negotiated between the applicant and the local governments (see Chapter 1 and Alternative V description in Chapter 2).

Land Use. All action alternatives would restrict potential postmining land uses (especially residential, commercial, and industrial uses) on about 400 acres at the tailings storage facility site. Minor land use changes would be associated with new mine-related housing and commercial development. The acquisition of land or placement of conservation easements for grizzly bear mitigation would restrict future residential and commercial development on about 3,074 acres for Alternative II, 2,692 acres for Alternative III, about 2,536 acres for Alternative IV, and 2,350 acres for Alternative V.

Changes in Old Growth Ecosystems

Effective Old Growth Habitat. Alternatives II through IV would destroy old growth or reduce its effectiveness. Alternative II would affect a total of 122 acres; Alternative III, 47 acres; and Alternative IV, 30 acres. Because of closure of some open roads, Alternative V would result in a slight increase in habitat effectiveness by 1 acre. Nevertheless, the percent of biologically effective habitat would be below the 8 to 10 percent needed to support old growth dependent species under all Alternatives I through V. However, all action alternatives would meet Forest Plan old growth management standards. Pileated woodpeckers, goshawks, and fishers are among old growth-associated species that would be affected by this loss. A potentially significant decline in local species diversity could result under the action alternatives that reduce old growth.

Changes in Wetlands and Non-wetland Waters of the U.S.

All four action alternatives would fill wetlands and non-wetland waters of the U.S. (see Table 2-6). The tailings storage facility footprint would directly and indirectly impact the similar total amount of wetlands for all action alternatives. Alternative V construction of the paste tailings facility phased-in throughout the 26-30 years of mining would delay the direct and indirect impacts to the wetlands, particularly those located directly under the tailings facility. The location of the mill site and waste rock dump and the alignment of FDR No. 150 determines the total amount of wetlands and non-wetland waters of the U.S. impacted by each alternative. Alternative II would impact a total of 8.1 acres of wetlands and 1.5 acres of non-wetland waters of the U.S. Alternative III would impact a total of 6.2 acres of wetland and 1.5 acres of non-wetland waters of the U.S., and Alternatives IV and V would impact a total of 6.2 acres of wetland and 0.4 acres of non-wetland waters of the U.S. These would be significant impacts.

Temporary indirect impacts to wetlands and non-wetland waters of the U.S. would occur during construction of roads and the mill pad due to increased sediment contributions. Proposed BMPs would reduce sediment contributions. Alternatives II and III would have temporary impacts at specified locations along Rock Creek from the confluence of the east and west forks to the Clark Fork River. Alternatives IV and V primarily would have indirect impacts below the confluence of the East Fork Rock Creek. Very few indirect impacts would be associated with the evaluation adit other than the reconstruction of FDR No. 2741. Alternative V would have nearly the same total acreage of indirect impacts as the other action alternatives, but the timing of the impacts would be delayed throughout the 26-30 years of mining with the past tailings construction.

The applicant has identified 18.9 acres of wetland mitigation sites and 1.5 acres non-wetland waters of the U.S. mitigation sites of which 12.3 were proposed for use under Alternative II (see Table 2-7). Only 10.5 acres of the wetland and non-wetland waters of the U.S. mitigation sites would be available for Alternatives III and IV due to the realignment of a segment of FDR No. 150. The applicant provided a revised wetland mitigation plan to specifically address Alternative V. In the revised plan, Sterling would create 10 acres of wetlands to compensate for the loss of 6.6 acres of wetland and non-wetland waters of the U.S. Mitigation sites would be developed prior to disturbing existing wetland and non-wetland waters of the U.S.

In addition to the revised Alternative V wetland mitigation plan, in 1998 the applicant identified six optional wetland mitigation sites that could be developed if the proposed sites prove to be less successful than anticipated for replacing the lost wetland functions and values (ASARCO 1998a).

Approximately 18.9 acres (Table 2-18) have now been identified as suitable for development of wetlands. The 1.1 acres of non-wetland waters of the U.S. at the upper mill site (Alternatives II and III) would not be reconstructed until the mill site was reclaimed. The 0.4 acres of non-wetland waters of the U.S. along the FDR No. 150 and the utility corridor under all action alternatives would be temporarily impacted during construction. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek, and attenuate peak flows. A temporary but potentially significant decrease in some of the wetland functions and values could occur until the created wetlands were revegetated and fully established.

Changes in Transportation

Public Access. All action alternatives propose both new road construction and road reconstruction. These activities would create traffic delays and temporary road closures. A traffic management plan would allow private landowners reasonable access to their property and public access to NFS lands.

Alternatives II and III would include a bypass around the west fork mill site to allow access to FDR Nos. 150 and 2741 above the mill. However, public access through either mill site or on the mine portal access road (all alternatives) would be restricted. Alternatives III through V would also restrict public traffic on FDR No. 150B around the impoundment.

The paving and widening of FDR No. 150 and upgrade of FDR No. 2741 would improve access to the CMW and for general recreational activities in the drainage. However, road closures would affect motorized recreational access. Under Alternative II, a total of 5.28 miles of road would be closed. Alternatives III and IV would close a total of 4.18 miles of road and would have slightly less impact than Alternative II to recreationists wanting closer motorized access to the wilderness via Orr Creek Road. A total of 1.88 miles of FDR No. 2741, Chicago Peak Road, would be closed under Alternatives II through IV. Under Alternative V, a total of 5.22 miles of road would be closed, but the Chicago Peak Road (FDR No. 2741) would be left open for easier wilderness access. Alternative V would close 2.9 miles of FDR No. 150 on Government Mountain, thus affecting motorized recreational access in that area. Indirect impacts to some wildlife species would be created by increased accessibility for hunting, trapping and poaching (see Big Game Animals, Sensitive Animal Species, and Mountain Goats). FDR No. 150 above the confluence mill site would not be paved for Alternative IV or V although minor improvements to FDR Nos. 150 and 2741 would occur for access to the evaluation adit; therefore, public access on those roads would remain similar to Alternative I.

Traffic Safety. The proposed project would generate increased traffic on FDR No. 2741 during evaluation activities and on Montana Highway 200 and FDR No. 150 during mine construction and operation for all action alternatives. Alternative III also would increase traffic on the lower portion of FDR No. 2741 during mine operation. Routing ore concentrate haulers along Montana Highway 200 to the Hereford rail loadout would create the potential for increased traffic accidents. Ore trucks would be traveling at slower speeds than general traffic and would be turning across the highway going to and from the loadout. Alternatives III and IV route the concentrate trucks along reconstructed FDR No. 150B at the base of the impoundment to the Government Mountain Road and the Miller Gulch rail loadout. This would eliminate conflicts between ore trucks and general traffic on the highway. Restricting public use of FDR No. 150B also would avoid conflicts on that portion of the haul route. Alternative V eliminates the need for concentrate haul trucks since the concentrate will be piped. Relocation of the rail loadout to Miller Gulch eliminates potential confrontations, including accidents, with residential traffic at Hereford.

Alternative II's proposed road alignment for the intersection of FDR No. 150 and Montana Highway 200 does not meet highway standards for sight distance, increasing the potential for accidents with turning traffic. Alternatives III through V would relocate the road intersection to comply with the standards.

Changes in Aesthetic Quality

Noise. Blasting during adit construction would generate noise up to 80 dBA in the CMW and the Clark Fork Valley. While general mine operations would not be audible in the Clark Fork Valley, the operation of heavy equipment at the impoundment site would be audible in adjacent areas. Activities at the Hereford rail loadout (Alternative II) would significantly increase noise levels to residences in the area. Relocation of the loadout to Miller Gulch under Alternatives III to V would eliminate that impact and place the noise in a less populated area.

Recreationists using the Rock Creek drainage and FDR Nos. 150 and 2741 would be able to hear mine and mill operations when they were within a mile of the facilities. Traffic related noise on FDR No. 150 would be increased significantly from 30 to 70 dBA. The level of the noise would be somewhat reduced in Alternatives III and IV with the implementation of several noise mitigations and to an even greater extent under Alternative V.

Noise impacts to recreationists within the CMW would be associated primarily with the evaluation and wilderness air intake ventilation adits and blasting and construction equipment noises (up to 80 dBA). Impacts from evaluation activities would be greatest during the first couple of years of mine activities; after that, noise would only be generated by ventilation exhaust fans. Sound from all adits would be audible (at 45 dBA) for approximately 1 mile away from the sites. The wilderness air intake ventilation adit would only be in place and used during the last 15 to 20 years of mining. These sounds would negatively impact CMW visitors using nearby areas. Sound mitigations in Alternatives III through V would reduce the fan noise to background levels (30 dBA) within 100 feet.

Scenic Quality. All four action alternatives would result in significant visual impacts for the Rock Creek drainage and Clark Fork Valley. Impacts would be associated with all features of the proposed project: the evaluation adit, the mill site, the mine portal and associated waste rock dumps, the air intake ventilation adit (see wilderness below), the utility corridors and the tailings impoundment/paste facility.

The evaluation adit portal would be most noticeable from Government Mountain, though the impacts would diminish with distance. Lights from night operations would be visible in portions of the Clark Fork Valley. These visual impacts would be reduced in Alternatives III through V. The waste rock dump would be revegetated to reduce contrast. Lights would be screened or baffled to reduce visibility across the valley.

The upper mill site in Alternatives II and III would be highly visible to the public using FDR Nos. 150 and 2741 but not be visible from the Clark Fork Valley. The conveyor from the mine portal would create a strong linear feature that would contrast greatly with the natural landscape. The cut-and-fill slopes of the new mine adit access road for Alternative II would be visible for a long time. Under

Alternative III, the new mine adit access road would not be built, reducing the amount of disturbance and visibility. The buildings would be painted or treated to reduce the amount of contrast.

The waste rock dump for Alternative II would be a prominent feature that would be difficult to revegetate and would remain highly visible for many years. The dump would be divided into two smaller dumps in Alternative III and graded closer to the natural slopes than was proposed in Alternative II. The dumps would be topsoiled and revegetated to facilitate reduction of visual impacts.

Alternatives IV and V would move the mill site to the confluence with the East Fork of Rock Creek. A minimum 100-foot visual buffer would be left on either side of FDR No. 150 to provide screening. There would be no separate waste rock dump for these alternatives as the rock would be used to build the mill pad and the impoundment starter dams or the paste facility toe buttresses. The face of the mill pad would be reclaimed immediately after construction. Visual impacts from the confluence mill site would be potentially significant.

Construction of either design of the impoundment or the paste facility would result in a large artificial form visible from several areas in the Clark Fork Valley. The size, form, color and texture of the tailings disposal facility would contrast dramatically with the surrounding landscape. The long-lasting effects would gradually be reduced as trees and shrubs were established. Revegetation with grass and forbes of the impoundment face would be done concurrently throughout mine life for Alternative II. Trees and shrubs, however, would be planted after the face of the impoundment was completely reclaimed for Alternative II. Alternatives III and IV would require additional detailed regrading and revegetation plans to facilitate the mitigation of visual impacts. Reclamation, including the planting of trees and shrubs for Alternatives III and IV, would begin after year 7 and would be concurrent until operations ceased. Trees would also be planted along Montana Highway 200 for screening as soon as Agency permits were approved. Under Alternative V, final reclamation would begin on paste surfaces when final grade was achieved with timing dependent on construction sequencing.

With proposed amendments to the Forest Plan under Alternatives II through V, new management areas (MA) MA 31 (Mineral Development) and MA 23 (Electric Transmission Corridor) would have no life-of-mine VQO. A post-mine VQO of Partial Retention would be applied to these management areas and would be met several decades following mine closure with the successful completion of reclamation activities, decommissioning and removal of above-ground facilities, and regrowth of vegetation. The impoundment surface and face under Alternative II may never meet Partial Retention VQO standards.

The prescribed Visual Management System (VMS) VQOs would not be achieved during mine life for all action alternatives. The impoundment surface potentially could never meet Retention VQO standards under Alternative II, but additional reclamation requirements under Alternatives III through V would increase the likelihood that the standard could be achieved within several decades after final reclamation. Under Alternative IV and V, the elimination of the waste rock dump, immediate planting of the mill pad face, and the visual buffer around the confluence mill site would further help this site meet VMS VQO standards. Although the facility sites could eventually achieve prescribed VMS VQOs several decades after mine closure and final reclamation, the additional reclamation requirements would shorten the amount of time required, but it would still take decades.

Wilderness. There would be two types of impacts to users of the CMW: noise-related and visual. The noise-related impacts would be greatest during the construction and operation of the evaluation adit, construction of the mine adits and mine pad and the construction and use of the wilderness air intake ventilation adit (see Noise). Mitigations under Alternatives III through V would reduce these potentially significant impacts. Visual contrast of the impoundment surface would remain for Alternatives II through IV due to its light color until completion of mine revegetation following mine closure. The phased reclamation of the paste facility would reduce its visual impact under Alternative V. The area of disturbance for the air intake ventilation adit would be reduced in Alternatives III through V by its relocation to a steeper site. Either location, however, is not in proximity to high use areas such as Rock, Saint Paul, and Moran lakes. Reclamation mitigations proposed under Alternatives III through V would restore a premining appearance to the air intake ventilation adit.

PART VI: THE AGENCIES' PREFERRED ALTERNATIVE

The Agencies' preferred alternative is Alternative V, Proposed Project with Tailings Paste Deposition and Alternate Water Treatment. Alternative V would result in construction of the evaluation adit, mine, mill, tailings paste facility, rail loadout, reverse osmosis and passive biotreatment facility, and access roads. The Bottom-Up construction option would be used and final design would incorporate measures to meet visual impact mitigation and reclamation goals. These measures are specified in Scenic Resources - Chapter 4 (see Alternative V Bottom-up Option). Some water would be stored in underground workings, but excess water would be discharged to the Clark Fork River after treatment. Environmental requirements in addition to those proposed by the applicant would be incorporated to avoid and minimize (to the extent possible) or eliminate environmental impacts. Additional monitoring would help detect trends as well as unacceptable impacts, should they occur. Measures would be developed to respond to and control any unacceptable impacts that may be detected.